

# A Revision of the New Zealand Recent and Fossil Species of *Estea* Iredale, 1915

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## ABSTRACT

The genus *Estea* Iredale is described and the recent and fossil New Zealand species are reviewed. Details of the radulae, opercula, penes, and external appearances of the animals of several species are given. A new subgenus is created for *Estea angustata* Powell; several species are synonymised, and two new species are described. Five species previously included in the genus are excluded.

## INTRODUCTION

The genus *Estea* has been used to cover a group of New Zealand and Australian shells of ovate-conical shape, with a smooth or sculptured surface, rounded aperture and thickened peristome. Australian workers have confused *Dardanula* and *Estea* (Cotton 1944, Laseron 1950), but these two entities are very different, belonging to quite different families (see Ponder, 1956a, b) *Estea* does not seem to have been recognised outside Australia and New Zealand, and Laseron (1956) does not record it from Northern Australia and Queensland. Wenz (1938) and Thiele (1929) do not recognise the genus, placing it as a synonym of *Pisinna* Monterosato. However *Pisinna* has a different aperture and is probably more closely related to *Cingula*, and therefore a true rissoid. *Estea*, on the other hand, belongs to a distinct group of subfamily status within the Rissoidae. In this revision 28 New Zealand species and subspecies are recognised and five species are discarded from the genus as previously recognised. These are:—

*E. crassicarinata* Powell, 1937 (Eatoniellidae) (see Ponder, 1965b).

*E. crassicordata* Powell, 1937 (new family) (see Ponder, —d).

*E. gibbera* Laws, 1950 (*Ovirissoa*, Rissoidae) (see Ponder, —c).

*E. gracilispira* Powell, 1933 (Eatoniellidae) (see Ponder, 1965b).

*E. minutula* Powell, 1933 (Eatoniellidae) (see Ponder, 1965b).

In this review, no attempt has been made to investigate the origins or relationships of the group outside New Zealand as I have not been able to see sufficient comparative material.

In New Zealand the genus first appears in the Middle Oligocene (Duntroonian) and there are a number of tertiary species, though the majority known are recent forms. No doubt, with increased collecting of microfossils, the group will become considerably larger and, perhaps, the ancestry of the recent forms will become evident. The state of our knowledge, at present, does not allow for much discussion on evolutionary lines as the fossil record is too fragmentary. A table is given in Appendix 1 of the distribution in time of the species of *Estea* and some tentative evolutionary sequences are suggested.

As many species of *Estea* are sculptureless and it is difficult to select a distinctive feature suitable for use in a key, no written key

is provided. However every species is illustrated, and this should prove a helpful guide in identification. The figures are all enlarged on the same scale so that an indication of relative size can be obtained.

A discussion in which *Estea* is considered in relation to allied genera is given by Ponder (—e).

The terminology and method used in the descriptions of the animal, operculum and radula is the same as that used by Ponder (1965b).

### Abbreviations

A.M.—Auckland Museum. A.U. Geol. Dept.—Auckland University Geology Department. Coll.—Collection. D.M.—Dominion Museum. G.S.—Geological Survey. O.I.—Oceanographic Institute.

### ESTEIA Iredale 1915

Type (o.d.): *Rissoa zosterophila* Webster, 1898

**Shell:** Small, oval, elongate, subrimate, dull or shining, smooth or sculptured with spirals or axials. Spire higher than aperture, conical, outline slightly convex to straight, usually a fair number of whorls. Protoconch dome-shaped, usually reddish, about two whorls, surface minutely pitted in many spiral series. Base rounded to subangled; suture usually not much impressed. Aperture oval, oblique, slightly angled above; peristome continuous, much thickened within, but sharp edged. Columella short, callous.

**Animal:** Cephalic tentacles club-shaped, with stationary cilia terminally and a tract of posteriorly directed cilia on ventral surface. Eyes in bulges at outer bases of tentacles. Snout rather large, bilobed, mobile. Foot moderately long, a distinct groove on anterior edge is only indication of propodium, posterior mucous gland distinct, opens into slit situated in posterior half of sole. Opercular lobes simple. No accessory tentacles. Penis coiled, simple, attached to midline some distance behind head.

An account of the anatomy of two species of *Estea* is given by Ponder, —a.

**Operculum:** Thin, transparent, colourless, oval, nearly flat, nucleus small, indistinct. Marginal areas usually narrow; muscle insertion area typically distinct occupying the columella half, marked with irregular short lines, slightly thickened.

**Radula:** Central rather large, with a pair of long basal processes, cusps 1-2 + 1 + 2-1, large. Lateral rather small, cusps 2 + 1 + 2-3, large, with a long, narrow, outer portion. Marginals elongate, curved distally, finely denticulate.

### Synonyms:

*Feldestea* Iredale, 1955 (*Alvania salebrosa* Frauenfeld, 1867; o.d.).  
*Nodulestea* Iredale, 1955 (*Estea castella* Laseron, 1950, o.d.).

***Estea zosterophila zosterophila* (Webster).** Pl. 17, figs. 1-4; Pl. 18, figs. 1-3.

1898 *Rissoa annulata* Suter (not of Hutton) Proc. Mal. Soc. Lond., 3, p. 3.  
1905 *Rissoa zosterophila* Webster, Trans. N.Z. Inst., 37, p. 277, pl. 9, fig. 5.

- 1913 *Rissoa (Cingula) zosterophila* Webster; Suter, Man. N.Z. Moll., p. 210, pl. 12, figs. 19 a, b.  
1915 *Estea zosterophila* (Webster); Iredale, Trans. N.Z. Inst., 4, p. 451.

*Estea zosterophila* has been much confused in the past because of its variability. There are two specimens labelled holotype and the largest and best preserved is chosen as the lectotype (pl. 18, fig. 1). It is redescribed below to facilitate the recognition of this species.

Shell small, oval, smooth, not shining. No sculpture other than growth lines. Spire very slightly convex; whorls  $5\frac{1}{2}$ , slightly convex, including a dome-shaped protoconch of  $1\frac{3}{4}$  whorls, which is brownish, worn, but minutely pitted spirals visible. Adult whorls dark brown, with a wide whitish subsutural band occupying about a third of penultimate, the lower boundary rather diffuse. This band covers upper half of body whorl, lower half being brownish, becoming yellowish over latter part. Base white, but behind aperture a yellowish-brown band in centre of whorl, which disappears before reaching aperture. Aperture white, except for columella and inner lip which are light yellowish-brown. Base rounded; suture not much impressed. Aperture slightly oblique, oval, weakly angled above; columella short, wide, callous; peristome continuous, much thickened within; outer lip with a sharp edge.

As the type has a dried animal inside it, we can presume that it was alive when collected, but has apparently faded. The protoconch of fresh specimens is dark wine-red and usually the spire is dark reddish-brown. The so-called characteristic colour bands are often absent, some shells being uniform dark brown or red-brown, although these intergrade with typical shells. Paratypes include many of the variations seen in the species, including intergrading series from large to small and dark to banded. A small dark reddish-brown shell (pl. 18, figs. 2 and 3), often called *minor* in collections, is common under stones, usually in exposed situations. This is but another form of *zosterophila*. One sinistrally coiled shell from Spirits Bay is in K. Hipkin's collection. Occasional hybrids with *E. simplicata* occur. These shells are of similar size to *E. zosterophila*, but have axial ribs on the body whorl and are intermediate in shape between the two species. *E. zosterophila* is characterised by its medium size, its moderately tall spire, small aperture which is not produced beyond the spire, generally dark coloration, and its subsutural white bands. The living New Zealand species most easily confused with *E. zosterophila* is *E. rekohuana*, which is rather larger, more solid and more inflated, with a characteristically larger aperture.

**Animal:** (Pl. 17, fig. 2). Exposed parts of animal usually peppered with varying amounts of black pigment over head and sides of foot. Cephalic tentacles short, club-shaped, compressed, usually semi-transparent, but sometimes pigmented, ciliated on ventral surface, with some stationary cilia on lateral edges of the distal half; eyes on swellings at outer bases of tentacles. Foot moderately long, sole white, with a mucous slit extending from middle region to posterior end, anterior end bluntly rounded, posterior end slightly notched by mucous slit. Presence of propodium only shown by ill-defined groove on anterior margin of foot. Anterior mucous gland not visible in living animal. Snout expanded in front,



slightly bilobed, a dark line, oral tube usually black. Buccal mass black, visible through head. Two unpigmented streaks passing out of mantle cavity on each side of head, terminate on edge of foot; cilia in both beat ventrally. Penis (pl. 17, fig. 3) coiled, not ciliated, about 2 coils, and lies behind the head affixed to the mid dorsal line.

For other details of the anatomy refer to Ponder, —a.

**Operculum:** (Pl. 17, fig. 4). Elongate—oval, rather thin, slightly curved in the longitudinal line. Nucleus small, indistinct. Muscle insertion area in columella half, distinct, thickened, marked with short, irregular, longitudinal lines. Marginal areas narrow. Growth lines indistinct.

**Radula:** (Pl. 17, fig. 1). Central small, with two basal processes, 2 + 1 + 2. Lateral rather small, with a large outer portion, 2 + 1 + 3. Inner and outer marginals elongate, inner broader, with about 12 small denticles, those of outer marginal smaller.

**Lectotype:** (Pl. 18, fig. 1). Devonport, Auckland (A.M.).

Height 2.15 mm.

Width 0.975 mm.

### Material Examined:

Holotypes and paratypes; off Motu Point, Cape Maria van Diemen, 21 fathoms, J. A. Bollons, 29/5/14 (D.M.); Cape Maria van Diemen, Finlay Coll. (A.M.); Spirits Bay, shell sand (Hipkins Coll.); Takapau Kura, Spirits Bay, algae, -/2/32 (Powell Coll.); between Cape Maria Island and the mainland, 4 fathoms, -/2/61 (Hipkins Coll.); Parengarenga (Geol. Dept. A.U.); Doubtless Bay, A. E. Brookes (Powell Coll.) and Oliver Coll. (D.M.); Taupo Bay, Whangaroa, W. LaRoche (Powell Coll.) and E. R. Richardson (D.M.); Cavalli Islands, Whangaroa, algae, -/6/52 (D.M.); Waiiau Beach, Mangonui, shell sand, E. R. Richardson (D.M.); Tapeka Point, Russell, -/1/52 (Hipkins Coll.); McGregor's Bay, Whangarei Heads, algae, under stones, 22/5/63 (W.F.P.); Smuggler's Bay, Whangarei Heads, *Corallina*, other algae, under stones, -/5/63 (W.F.P.); Taurikura Bay, Whangarei Heads, coralline algae, under stones, -/5/63 (W.F.P.); off Castle Rock, Taurikura Bay, 3-4 fathoms, 7/5/61 (W.F.P.); 1 fathom, Taurikura Bay, decaying algal detritus (W.F.P.); main channel, Taurikura Bay, on *Glycymeris* valves, 7/5/62 (W.F.P.); Ocean Beach, Whangarei Heads, brown and red algae, 7/5/62 (W.F.P.); Poor Knights Islands, under stones in rock pools, 4/4/64 (W.F.P.); Bream Tail, under stones *Corallina*, *Carpophyllum*, 12/8/63 (W.F.P.); Laings Beach, Mangawai, shell sand (Hipkins Coll.); Goat Island Beach, Leigh, *Corallina*, various algae, under stones, 1962-64 (W.F.P.); Tawharanui Point, North side, brown algae in rock pools, under stones, 31/12/63 (W.F.P.); Tryphena, Great Barrier Island (Powell Coll. and Hipkins Coll.); Whangaparapara, Great Barrier Island, R. K. Dell, Dell Coll. (D.M.); Shoal Bay, Great Barrier Island, algae (Hipkins Coll.); Okupu, Great Barrier Island, under stones, *Carpophyllum*, *Corallina*, -/11/63 (W.F.P.); Kaitoke, Great Barrier, coralline algae, *Ulva*, 16/11/63 (W.F.P.); Waiwera, exposed side of reef, coralline algae, 16/2/64 (W.F.P.); Muriwai, coralline algae, under stones (W.F.P.); Manukau Harbour, 4 fathoms, off Wairoa, Waiuku Channel, S. Hulme (W.F.P.); Cornwallis, Manukau Harbour, silted *Corallina*, 7/1/62 (W.F.P.); Matiatia, *Corallina*, 28/12/30 (G.S.); Takapuna, Auckland, under stones (Hipkins Coll.) and under stones, brown algae, *Corallina*, 1962-64 (W.F.P.); Tiritiri Island, *Corallina*, 4/9/31 (C.S.); Motutapu Island, Auckland, under smooth stones (Powell Coll.); Campbell's Bay, Auckland, Laws Coll. (Geol. Dept. A.U.) and *Caulerpa*, W. Ballantine, (W.F.P.); Devonport, Auckland, Webster Coll. (Powell Coll.); Howick, Auckland, *Corallina* (W.F.P.); West Tamaki Heads, Auckland, *Corallina*, -/8/62 (W.F.P.); St. Heliers Bay, Auckland (A.M.); Puru, near Thames, -/8/58 (W.F.P.); Jackson's Bay, Coromandel, fine red algae, 29/3/64 (W.F.P.); Sandy Bay, Coromandel, 30/3/64, *Corallina* (W.F.P.); Stony Bay, Coromandel, coralline and other short algae on stones, 28/3/64 (W.F.P.); Pilot Bay, Tauranga, on stones, A. W. B. Powell, (Powell Coll., G.S., and Geol. Dept. A.U.);



Omokoroa, Tauranga Harbour, 31/8/58 (W.F.P.); Mount Maunganui (G.S.); 46-82 fathoms, N.N.E. of Mayor Island in fish stomach contents, G. Williams (Powell Coll.); Cape Runaway, under stones, -/8/33, A. W. B. Powell (Powell Coll.); Tolaga Bay, shell sand (D.M.); Kaiti Beach, Gisborne, shell sand (D.M.); Tatapouri, Poverty Bay (D.M.); Cape Kidnappers (D.M.); Castle Point, *Corallina*, J. E. Morton (W.F.P.); Island Bay, Wellington, *Corallina*, 21/2/62 (W.F.P.); Lyall Bay, Wellington, Suter Coll. (G.S.) Lyall Bay (D.M.); Owhiro Bay, Wellington, *Corallina*, 20/2/63 (W.F.P.); Makara Beach, M. Mestayer, 26/8/26 (D.M.); Titahi Bay, shell sand (D.M.); Long Beach, Durville Island, rock pools, W. R. B. Oliver (D.M.); *Fossil*: Ohope (Castlecliffian), Laws Coll. (Geol. Dept. A.U.).

**Distribution:** The East and West coasts of the North Island and the North of the South Island, in the littoral zone and down to a few fathoms.

**Ecology:** *E. zosterophila*, over most of its range, lives on algae, especially *Corallina*, and under stones. In the southern part of its range, however, this species seems to be restricted to *Corallina*, while *E. rekoahuana* lives under stones.

***Estea zosterophila ngatutura* Laws. Plate 18, fig. 4.**

1939 *Estea ngatutura* Laws, Trans. N.Z. Roy. Soc. 68, p. 436, pl. 61, fig. 44.

This subspecies is possibly ancestral to *E. zosterophila zosterophila*, from which it differs in its smaller size, more convex outline, and more deeply impressed suture. The aperture is small as in *E. z. zosterophila*, but rather more D-shaped; the columella being nearly vertical, and the inner lip forming the straight part of the D. The inner lip is more horizontal than in *E. z. zosterophila*.

**Holotype:** Kaawa Creek (Opoitian (G.S.)).

Height 1.5 mm.      Width 0.7 mm.

**Material Examined:** Holotype and paratypes.

***Estea asymmetrica* Laws. Plate 21, figs. 5, 6.**

1941 *Estea asymmetrica* Laws, Trans. Roy. Soc. N.Z., 71, p. 140, pl. 18, fig. 28.

This species is related to the much better known *E. impressa* (Hutton), but differs in the more slender shell and fewer and sharper axials (16 axials on the penultimate whorl against 24 or more in *E. impressa*) which have much wider interstices. There is a spiral rib below the suture, although this is not formed by the top of the axials being cut off by an incised spiral line as in *E. impressa*, but by a true subsutural spiral cord which is visible in the interstices. There is also a supra-sutural spiral cord, which is rather more strongly developed than the subsutural cord on the antepenultimate whorl, but weaker on the body whorl, and forms a spiral cord across the periphery. This is weak in the holotype but strong in the one paratype. These cords are rendered distinctly nodulose by the axials.

Closely comparable to the fossil types are some recent specimens from the North East of the North Island (fig. 6). The main difference is the absence of a peripheral spiral, but a suprasutural spiral is present on the spire whorls. They have similar coloration and 'texture' to *E. impressa* with which they are found, but they are easily distinguished by other characters. There are 15-17 axials on the penultimate whorl of the recent specimens. Their protoconchs are reddish, and the whorls are

sharply angled and sculptured with about six finely granulated spiral lines. Since these specimens agree closely with the fossil types, they are considered to be the same species, despite the absence of inter-connecting fossil specimens.

**Holotype:** (Fig. 5). Pakaurangi Point, Kaipara (Altonian) (G.S.).  
Height 1.95 mm. Width 0.875 mm.

### Material Examined:

Holotype and one paratype; Waimamaku (Otaian) (Geol. Dep. A.U.). *Recent*: Doubtless Bay, 12 fathoms, Finlay Coll. (A.M.); off Mayor Island, 35-80 fathoms, in stomach contents of Terakiki, G. Williams, (Powell Coll.).

**Distribution:** Otaian to Recent. Recent distribution in the N.E. of the North Island in moderately deep water.

### *Estea hipkinsi* n. sp. Plate 21, fig. 9.

Shell of moderate size for genus, weakly axially costate on last whorl. Spire elongate-conic, about twice height of aperture. Whorls  $5\frac{1}{2}$ , nearly flat, including protoconch of  $1\frac{1}{2}$  whorls, which is dark red in colour, with about 10 lines of granules. Traces of axials on first  $2\frac{3}{4}$  whorls but on last  $1\frac{1}{4}$  whorls are moderately strong, rounded, nearly vertical axials reaching from suture to suture, extending over base but becoming nearly obsolete on last  $\frac{1}{4}$  whorl. About 36 axials on body whorl, interstices narrow. Aperture slightly oblique, oval, angled above, peristome continuous, with a sharp edge, thickened within. Columella short, callous, inner lip thin. Colour of spire reddish owing to colour of internal chitinous shell layer. Worn specimens have a wide, yellowish-white band below suture on spire, but this purplish-grey in holotype. Body whorl and penultimate yellowish with a faint brown band below suture, and two others just below periphery which coalesce a little behind the aperture. Aperture white, columella mostly brown.

**Holotype:** (Fig. 9). Spirits Bay S.S. Collected R. S. Bird, -/6/51 (Hipkins Coll.) (A.M.).  
Height 2.375 mm. Width 1.3 mm.

### Material Examined:

Spirits Bay in shell sand, 1949 Collected Mrs I. Worthy (Hipkins Coll.); 4 fathoms between Cape Maria Island and the mainland, -/2/61 (Hipkins Coll.).

**Distribution:** The far North of the North Island.

The new species differs from *E. impressa* (Hutton) by the absence of a subsutural incised spiral and its larger size. It has some superficial resemblance to *E. semiplicata* Powell which, however, belongs to quite a different group. *E. hipkinsi* differs in having more numerous and weaker axials, and different coloration. *E. manawatawhia* has strong axials over all its whorls. The new species is probably fairly close to certain Australian species but in the absence of comparative material no discussion is possible.

### *Estea impressa* (Hutton). Plate 17, figs. 7-9; Pl. 21, figs. 1-3.

1885 *Rissoa impressa* Hutton, Trans. N.Z. Inst., 17, p. 321.

1893 *Rissoa impressa* Hutton; Hutton, Macleay Mem. Vol., Pliocene Moll., p. 64, pl. 8, fig. 64.

- 1905 *Rissoina agrestis* Webster, Trans. N.Z. Inst., 37, (1904 (1905) ), p. 279, pl. 10, fig. 10.  
 1907 *Rissoa impressa* Hutton; Suter, Trans. N.Z. Inst., 39, p. 257.  
 1913 *Rissoa (Rissoa) impressa*, Hutton; Suter, Man. N.Z. Moll., p. 201, pl. 12, fig. 3.  
 1915 *Rissoa impressa*, Hutton; Suter, Geol. Surv. Bull., 3 p.4.  
 1915 *Estea impressa* (Hutton); Iredale, Trans. N.Z. Inst., 47, p. 454.  
 1924 *Haurakia mixta* Finlay, Trans. N.Z. Inst., 55, p. 482, fig. 1.  
 1924 *Estea impressa* (Hutton); Finlay, Trans. N.Z. Inst., 55, p. 487.  
 1929 *Estea verticosta* Powell and Bartrum, Trans. N.Z. Inst., 60, p. 415, pl. 37, figs. 25, 26.

Much variation is seen in this species; size, relative width, number and degree of slope of the axial ribs, and strength of the subsutural cord, being the most variable features. Fossil specimens (including the types), are on the average, larger than recent shells, though this is not always the case. In many northern localities large and small specimens are found living together (figs. 2 and 3), but there are no differences between them other than size.

The shell is easily recognised by its small size, rather convex spire, numerous axial ribs (20-25 on the penultimate) extending over all the adult whorls, and the incised spiral line below the suture forming a row of nodules on the ribs between the line and the suture. The colour is distinctive, being pinkish to red, with the body whorl yellowish or white. The protoconch is red, and sculptured with fine, spiral, granulated lines, and its whorls are convex to sharply angled. *E. olivacea* Frauenfeld (pl. 21, fig. 4) differs from *E. impressa* mainly in minor details of colour and sculpture. The Australian shells are uniform yellowish brown and the spire whorls tend to develop only subobsolete axials. *E. verticosta* Powell and Bartrum comes well within the range of variation of *E. impressa*. The authors state that the suture is not margined, but this is not the case in the holotype and the one paratype.

Iredale (1955) has provided a genus *Nodulestea* for *Estea castella* Laseron. This species is, in fact, very closely related to *E. olivacea* and *E. impressa*, the main difference being that instead of one row of nodules there are three, which extend over the whole whorl surface. They are formed in the same manner as the single, spiral, nodulose cord of *E. olivacea*, i.e. by incised spiral lines cutting the strong axial sculpture. Since *E. impressa* and *E. olivacea* are clearly typical *Estea*, to separate *E. castella*, even at the subgeneric level, would be a most undesirable move. Thus *Nodulestea* Iredale, 1955, is a synonym of *Estea* Iredale, 1915.

**Animal:** External coloration white, snout slightly bilobed, tentacles short, club-shaped, ventral surface with active cilia, distal half of tentacles with long immobile cilia; eyes rather large, in swellings at outer bases of tentacles. Foot rather long, anterior end bluntly rounded, with long, posteriorly lashing, cilia just behind anterior edge on sole. Rest of sole with posteriorly directed cilia, posterior end rounded, mucous slit extending from middle region to posterior end. Penis (pl. 17, fig. 8) long and narrow, pointed, about 2 coils, attached to mid-line.

**Operculum:** (Pl. 17, fig. 9). Oval broader than *E. zosterophila*, muscle insertion area not distinct, marginal areas narrow. Faint spirals and growth lines are only sculpture.



**Radula:** (Pl. 17, fig. 7). Central with two long, oblique, latero-basal processes, and two short basal projections, cusps 1 + 1 + 1. Lateral with long outer portion, cusps 2 + 1 + 2. Inner marginal with about 12 fine denticles. Outer marginal apparently smooth.

**Lectotype:** (Fig. 1). (Chosen by H. Suter) Petane (Nukumaruan) (Cant. Mus.).

Height 2.275 mm.

Width 1.05 mm.

### Material Examined: Fossil—

Lectotype and paralectotype; Pohangina (Dunroonian) Laws Coll. (Geol. Dept. A.U.); Matiatia, Waiheke Island (Altonian) (holotype and paratype of *E. vertiscosta*) (A.M.); Kaawa Creek, (Opoitian) Laws Coll. (Geol. Dept. A.U.); Wilkies Bluff (Waitotaran), Laws Coll. (Geol. Dept. A.U.); Nukumarau (Nukumaruan or Hautawan), Laws Coll. (Geol. Dept. A.U.); Nukumarau Brown Sands (Nukumaruan) (G.S. and Powell Coll.); Tahoraite, S.E. 120 chains at 160° to trig A.W., Hawke's Bay (Nukumarian) (G.S.); Takapau S.D., N.E. (Nukumaruan) (G.S.); Hunterville, Turakino, Valley Road, (Nukumaruan) (G.S.); Castlecliff (Castlecliffian) Laws Coll. (Geol. Dept. A.U. and G.S.); Castlecliff 'B' (Castlecliffian) (G.S.); Ohope (Castlecliffian) Laws Coll. (Geol. Dept. A.U.); Waikopiro, Wanganui (Castlecliffian?) (locality uncertain) (G.S.); Motunau Raised Beach (Hawera series) (upper Pleistocene) (G.S.). *Recent:* N.Z.O.I. Stat. C. 760, 34° 10.8' S., 172° 8.4' E., off Three Kings Islands, 44 fathoms, bryozoan substrate, 18/2/62 (O.I.); 4 fathoms, between Cape Maria Island and mainland (Hipkins Coll.); Cape Maria van Diemen, Suter Coll. (G.S.); Cape Maria van Diemen, Dell Coll. (D.M.); Kapo Wairoa, Spirits Bay (Powell Coll.); Spirits Bay, shell sand (Hipkins Coll.) and 29/12/50 (Gardner Coll.); Waiiau Beach, Mangonui, E. R. Richardson, 11/12/50 (D.M.); Doubtless Bay, 12 fathoms, Finlay Coll. (A.M.); Taupo Bay, Whangaroa, 2/1/54 (Hipkins Coll.); E. R. Richardson, 11/4/51 (D.M. and G.S.); Tapeka Point, Russell, R. K. Dell, 28/11/50 (D.M.) and -1/52 (Hipkins Coll.); Taurikura Bay, Whangarei Heads, 1 fathom, -5/63 (W.F.P.); Taurikura Bay, under stones, coralline algae, -5/63 (W.F.P.); off Castle Rock, Taurikura Bay, 3-4 fathoms and in the main channel, in *Glycymeris-Tawera* community -5/62 (W.F.P.); Smuggler's Bay, Whangarei Heads, under stones, low tide, -5/63 (W.F.P.); Ocean Beach, Whangarei Heads, *Carpophyllum plumosum*, 7/5/62 (W.F.P.); dredged off Mokohinau Islands (W.F.P.); Poor Knights Islands, under stones in rock pools at low tide, 29/3/64 (W.F.P.); 22 fathoms, off the Hen and Chickens Islands, Finlay Coll. (A.M.); Near Little Barrier, 20 fathoms, Suter Coll. (G.S.); Tryphena, Great Barrier Island, Finlay Coll. (A.M.) (and G.S.) Shoal Bay, Great Barrier, algae washings (Hipkins Coll.); Whangaparapara, Great Barrier Island, R. K. Dell, Dell Coll. (D.M.); Okupu, Great Barrier Island, under stones and in *Corallina*, 24/11/63 (W.F.P.); Bream Tail, under stones, 12/8/63 (W.F.P.); Goat Island Bay, Leigh, under stones 1/1/64 (W.F.P.); Tiri Tiri Island (G.S.); Tawharanui Point, North side, under stones on papa platform (W.F.P.); Waiwera, on exposed side of reef, *Corallina*, 16/2/64 (W.F.P.); Motuihe Channel, off Emu Rock, 8 fathoms, *Tawera-Glycymeris* community, 15/5/63 (W.F.P.); Channel Island, Suter Coll. (G.S.); West Tamaki Heads, Auckland, coralline algae on rock platform, under stones in pools, (W.F.P.); Takapuna, Auckland, Suter Coll. (G.S.); Takapuna and Narrow Neck, Auckland, under stones, *Corallina*, 1962-64 (W.F.P.); St. Heliers Bay, Auckland, Finlay Coll. (A.M.); 10 fathoms off Kauri Point, Auckland Harbour (Powell Coll.); Kohimarama (G.S.); Jackson's Bay, Coromandel, under stones, 29/3/64, (W.F.P.); Stony Bay, Coromandel, *Corallina*, other short algae, under stones, 28/3/64 (W.F.P.); 96 fathoms, 1½ miles N.N.E. off Mayor Island, S. M. Howell (Powell Coll.); Mayor Island, 35-80 fathoms, G. Williams (Powell Coll.); Cape Runaway, under stones, A. W. B. Powell (Powell Coll.); Tolaga Bay, R. K. Dell, 28/11/50 (D.M.); Island Bay, Wellington, shell sand, 2/10/56 (W.F.P.); Eastbourne, Wellington, (W.F.P.); B.S. 101, off White Rocks, Queen Charlotte Sound, 25 fathoms, (D.M.); B.S. 129, Pelorus Sound, 25-30 fathoms, M.V. "Alert", (D.M.); Pile Bay, Lyttelton Harbour, Dell Coll. (D.M.); East of Diamond Harbour, Lyttelton Harbour, *Corallina*, under stones, -9/63 (W.F.P.); Waitangi, shell sand (G.S.); Chatham Island Exped. Stat. 38, South of Little

Mangere, 43 fathoms, M.V. "Alert", 2/2/54 (D.M.); 10 fathoms, off Owenga, Chatham Islands, A. W. B. Powell, -/8/33 (A.M.).

**Distribution:** Duntroonian to Recent. The recent geographical distribution is the North Island East Coast, the Marlborough Sounds and the East Coast of the South Island, at least as far south as Banks Peninsula. I have not seen *E. impressa* from the West Coasts of either Island. It also occurs at the Chatham Islands. Typically living under stones in the littoral zone, it may also occur on coralline and other algae. The depth range is not great, for sublittorally this species seems to be restricted to hard bottoms such as those occurring in tidal channels.

***Estea insulana insulana* Marwick. Plate 19, fig. 1.**

1928 *Estea insulana* Marwick Trans. N.Z. Inst. 58. p. 478, fig. 115.

This fossil is very similar to the recent *E. porrecta* Powell which is best considered to be subspecific. The surface is smooth and shining, with faint growth lines. The paratypes are all very like the type, but one is a little more slender (2.7 x 1.15 mm.). The fossil subspecies differs from the recent form by its slightly shorter spire. Powell (1933, p. 201) and Dell (1960, p. 146) record "cf. *insulana*" from the Chathams as a recent shell. However, it seems that all the recent material should be referred to *porrecta*, because, on the average, the recent shells are taller, and no distinct line exists between the short and tall spired forms.

**Holotype:** (Fig. 1). Titirangi, Chatham Island (Nukumaruan) (G.S.).  
Height 2.4 mm. Width 1 mm.

**Material Examined:** Holotype and paratypes.

**Distribution:** Nukumaruan, middle Pleistocene.

***Estea insulana porrecta* Powell. Plate 19, figs. 2-4.**

1928 *Estea* c.f. *subfusca* (Hutton); Finlay, Trans. N.Z. Inst., 59, p. 242.

1933 *Estea porrecta* Powell, Rec. Auckland Inst. Mus., 1 (4), p. 201, pl. 35, fig. 8.

1933 *Estea* c.f. *insulana* Marwick; Powell, Rec. Auckland Inst. Mus., 1 (4), p. 201.

1960 *Estea porrecta* Powell; Dell, D.S.I.R. Bull., 139 (4), p. 146.

1960 *Estea* c.f. *insulana* Marwick; Dell, D.S.I.R. Bull., 139 (4), p. 146.

This shell is distinguished by the very tall spire, smooth surface, slightly convex whorls, medium size and oval aperture.

The type of *porrecta* is a tall, beach worn shell. The colour of fresher specimens (Chatham Islands Exp. Stn. 38) is reddish-purple, with the last half of the body whorl and the protoconch, yellowish. The height of the spire varies in recent specimens (c.f. figs. 2 and 4), and the shorter spired forms (fig. 2) are very close to *insulana insulana*.

**Holotype:** (Fig. 3). Waitangi, Chatham Islands, -/2/33 (A.M.).  
Height 2.575 mm. Width 0.95 mm.

**Material Examined:**

Holotype; Chatham Islands Exped. Stn. 38, South of Little Mangere in 43 fathoms, M.V. "Alert", 2/5/54 (D.M.); Chatham Island Exped. Stat. 20, 43° 39' S., 176° 34.5' W., off Cape Young, 20 fathoms, M.V. "Alert", 28/1/54 (D.M.); Chatham Islands Exped. Stat. 23, 43° 32.5' S., 176° 47.5' E., North of the Sisters, 33 fathoms, 29/1/54, M.V. "Alert" (D.M.); off Owenga, Chatham Islands, 10 fathoms, A. W. B. Powell (A.M.).



**Distribution:** The Chatham Islands in moderately deep water.

***Estea insulana porrectoides* Powell.** Plate 19, figs. 6-8.

1937 *Estea porrectoides* Powell, Disc. Rep., 15, p. 197, pl. 53, fig. 1.

The convex spire, flattened whorls and small thickened aperture make this form rather distinctive, though it is closely related to *insulana* and should be considered as subspecific, as it has a distinct geographical distribution. The paratypes are dead shells and most of them are rather worn, though in the best preserved specimens fine oblique axial growth striae are visible on the body whorl. The colour of the protoconch is yellowish, and the spire dark reddish-brown to yellow, usually with a paler (often white) subsutural band. The body whorl is lighter in colour, and the columella brown.

There is a shallow water form of this subspecies which is similar in outline and apertural details. It differs in being smaller in size with a relatively shorter spire, and much stronger axial striae, which are often developed over the entire shell. Sometimes a dark colour band is developed on the periphery (fig. 8).

Two shells from Discovery II Station 929 (fig. 7) are very close to *E. insulana porrecta* Powell in shape, as they have rather convex whorls. However they probably represent a form of *porrectoides*.

**Holotype:** Off the Three Kings Islands, Discovery II Station 933, in 260 metres (Brit. Mus.).

Height 2.55 mm.                      Width 1.1 mm. (from Powell)

### Material Examined:

Paratypes (Powell Coll.); Discovery II Station 929 off Spirits Bay, 59 metres (Powell Coll.); 50 fathoms, between Cape Maria van Diemen and the Three Kings Islands, 1961 (Hipkins Coll.); 4 fathoms, between Cape Maria Island and mainland, -/2/61 (Hipkins Coll.); Cape Maria van Diemen, Dell Coll. (D.M.); Spirits Bay, shell sand (Hipkins Coll.); 4½ fathoms, off Reach Island, Whangaroa (W.F.P.); 22 fathoms, ½ mile south of Stephenson's Island, 3½ miles from Whangaroa, 29/12/53 (Hipkins Coll.); Whangaroa Heads, Dell Coll. (D.M.); 38 fathoms off Cuvier Island, Finlay Coll. (A.M.); 18 fathoms off Taranga (Hen) Island (G.S.); 45 fathoms, 1 mile off East side of Mayor Island in Terekiki stomach contents, G. Williams, 3/12/49 (Powell Coll.); 35 fathoms, Tuhua Reef, Mayor Island, fish stomach contents, G. Williams (Powell Coll.).

**Distribution:** The North East coast of the North Island North of East Cape, usually in fairly deep water.

***Estea koruahina* Laws.** Plate 21, fig. 11.

1939 *Estea koruahina* Laws, Trans. Roy. Soc. N.Z., 68, p. 436, pl. 61, fig. 37.

All the specimens which have been seen of this species are very badly eroded or immature. The holotype is an adult shell and the outline of fig. 11 is taken from it, but details of the sculpture are derived from that remaining on the holotype and three paratypes. The juvenile paratypes are better preserved and in them the spire appears to be smooth, but the last third of the penultimate whorl and the first two-thirds of the body whorl have rounded axials and 4 spiral cords. The axials terminate on the third spiral, and both the third and fourth are smooth and rather weak. The first is subsutural and rendered faintly nodulous by the axials, and the second is wide, but indistinct, slightly nodulous and a little below the middle of the whorl. The base is distinctive in having a well-developed fold supporting the columella which is separated



from the rest of the base by a weak groove. Most species of *Estea* have this fold weakly developed, owing to a tendency of the aperture to uncoil slightly, but it is relatively massive in *koruahina*.

This species is possibly related to *E. simplicata* Powell, but seems to be even closer to *E. rugosa* (Hutton).

**Holotype:** Kaawa Creek, Auckland (Opoitian lower Pliocene) (G.S.).  
Height 2.8 mm. Width 1.45 mm.

**Material Examined:** Holotype and paratypes; Kaawa Creek (Opoitian) (Geol. Dept. A.U.).

**Distribution:** Opoitian.

***Estea manawatawhia* Powell. Plate 21, fig. 7.**

1937 *Estea manawatawhia* Powell, Disc. Rep. 15, p. 198, pl. 53, fig. 3.

*E. manawatawhia* is unlike any other New Zealand species, with its heavy axial ribs extending on to the base (about 16 on the penultimate), and brown and white colour bands. There appears to be very little variation. Animal unknown.

**Holotype:** Discovery II Station 932, off the Three Kings Islands, 185 metres, (Brit. Mus.).

Height 2.7 mm. Width 1.4 mm. (from Powell)

**Material Examined:**

Paratypes; (Powell Coll.); N.Z.O.I. Stat. C. 760, 34° 10.8' S., 172° 8.4' E., off Three Kings Islands, 44 fathoms, bryozoan substrate, 18/2/62 (O.I.).

**Distribution:** Off the Three Kings Islands in moderately deep water.

***Estea micronema micronema* (Suter). Plate 19, figs. 12-14.**

1873 *Rissoa purpurea* Hutton, Cat. Mar. Moll. N.Z. p. 29, (not *R. purpurea* Jeffreys, 1841).

1898 *Rissoa subfusca micronema* Suter, Proc. Mal. Soc. Lond., 3, p. 4.

1909 *Rissoa (Cingula) subfusca micronema* Suter; Suter, Subantarctic Islands, N.Z. 1, p. 17.

1913 *Rissoa (Cingula) subfusca* Hutton; Suter, (in part), Man. N.Z. Moll. p. 210.

1913 *Rissoa (Cingula) subfusca micronema* Suter; Suter, Man. N.Z. Moll. p. 210.

1915 *Estea subfusca* var. *micronema* (Suter); Iredale, Trans. N.Z. Inst., 47, p. 454.

1928 *Estea subtilicosta* Marwick, Trans. N.Z. Inst., 58, p. 478, fig. 116.

1955 *Estea micronema* Suter; Powell, D.S.I.R. Cape Exped. Series, Bull., 15, p. 83.

1956 *Estea sculpturata* Dell, Dom. Mus. Bull., 18, p. 62, fig. 18.

This distinctive species has not previously been figured under its correct name. It is easily distinguished by its cylindrical, slightly convex spire, reticulate sculpture and circular often projecting, aperture. The first half of the first adult whorl in the lectotype is nearly smooth with only a few indistinct axials, but many specimens have the typical adult sculpture extending nearly to the protoconch. In the type specimen there are about 15 spirals on the penultimate whorl, and these cross rather irregular axials, rendering them weakly nodulous. The whole effect is to give a crisply nodulous appearance to the surface. The whorls are very lightly convex but in some specimens, including the type, the penultimate is slightly angled and cut into the suture in its lower quarter, but this is not always the case. The protoconch is typical for

the genus. Fresh shells are purplish-red on the spire while the body whorl and aperture are yellowish-white or white. Specimens from some localities (e.g. the Snares Islands) reach a larger size than the type and have more spirals per whorl, but are otherwise indistinguishable from it. *E. sculpturata* Dell (fig. 13), from off the East Otago Coast in 300 fathoms, is identical with *E. micronema*, while *E. subtilicosta* Marwick (fig. 14), a fossil from the Chatham Islands, is very close indeed to recent shells and should be considered conspecific. The fossil shells do not show any spiral sculpture, but neither do worn recent shells.

**Lectotype:** (Fig. 12). Stewart Island, 15 fathoms (G.S.).

Height 2.825 mm.                      Width 1.15 mm.

### Material Examined:

Lectotype and paralectotypes; 40 and 72 fathoms, off Otago Heads, Laws Coll. (Geol. Dept. A.U.); 60 fathoms, off Otago Heads, Finlay Coll. (A.M.); B.S. 190, off East Otago Coast, 300 fathoms (D.M.) (holotype and paratypes of *E. sculpturata*); 72 fathoms, off Cape Saunders, Otago, Laws Coll. (Geol. Dept. A.U.); Bluff, Finlay Coll. (A.M.); Foveaux Strait oyster beds, (D.M.); Fish Rocks, Foveaux Strait, 30 fathoms, O. Allan, -/6/51 (D.M.); Foveaux Strait, 15 fathoms, A. Hamilton (Powell Coll.); middle grounds, Foveaux Strait, 30 fathoms, O. Allan, -/6/51 (D.M.); Stewart Island, 15 fathoms, H. Suter (D.M.); 170 fathoms off Puysegur Point S.W. Otago (Powell Coll.); B.S. 106, between Unnamed Island and Breaksea, Dusky Sound, 20 fathoms, M.V. "Alert", 7/5/58 (D.M.); B.S. 104, Chalky Inlet, 20 fathoms M.V. "Alert", W. H. Dawbin, 6/5/50 (D.M.); 50 fathoms, Snares Islands, Finlay Coll. (A.M.) and Suter Coll. (G.S.). *Fossil*: Titirangi, Chatham Island (Nukumaruan) (holotype and paratypes of *E. subtilicosta*).

**Distribution:** Moderately deep, to deep water, in the South of the South Island, Stewart Island and the Snares.

**Fossil Distribution:** Nukumaruan, lower Pleistocene.

**Remarks:** The Australian *E. amblycorymba* Cotton (1944), has similar sculpture.

***Estea micronema morioria* Powell.** Plate 19, figs. 15, 15a.

1933 *Estea morioria* Powell, Rec. Auck. Inst. Mus. 1 (4), p. 200, pl. 35, fig. 6.

This subspecies is about half the size of *micronema micronema*, but is a similar shape and has the same sculpture. The holotype consists of two fragmentary specimens, one having only a body-whorl and the other with the aperture missing. The sculpture is of coarse, close, axial growth lines, which are slightly nodulated by weaker spirals placed at fairly wide intervals (about 20 on the B.W.) giving a rugose appearance to the shell. The protoconch is dome-shaped, and is sculptured with about 16 rows of dots. The dead shells are brown in colour, with a narrow whitish subsutural band. There is a pale smooth line running across the periphery which is weakly subangled.

*E. m. morioria* is slightly more conical in outline than *E. m. micronema*, and has much finer sculpture (but this is due to its smaller size), and a more coarsely striated protoconch. The outer-lip has no posterior sinus, whereas it is weakly developed in *E. m. micronema*.

**Holotype:** (Figs. 15, 15a). 10 fathoms, off Owenga Beach (A.M.).

Height 1.9 mm. (estimated)                      Width 0.7 mm. (estimated)

**Material Examined:** Holotype.

**Distribution:** Chatham Islands.

***Estea minor* (Suter).** Plate 18, figs. 5, 6.

1898 *Rissoa annulata* var. *minor* Suter, Proc. Malac. Soc. Lond. 3, p. 3.

1913 *Rissoa (Cingula) zosterophila* var. *minor* Suter; Suter, Man. N.Z. Moll., p. 211.

1915 *Estea zosterophila* var. *minor* (Suter); Iredale, Trans. N.Z. Inst., 47, p. 454.

1933 *Estea minor* Powell, Rec. Auck. Inst. Mus. 1 (4), p. 200, p. 135, fig. 4, (lectotype).

1934 *Amphithalamus (Pisinna) kohl-larseni* L. David; Senckenbergiana 16, Nos. 2-3, p. 133, fig. 4.

1955 *Estea minor* Powell, D.S.I.R. Cape Exped. Series Bull., 15, p. 83.

Minute size, dark coloration, smooth, shining surface and bulging middle whorls are the keynotes of this species. The lectotype has an orange-red spire, but the body whorl is lighter in colour, the aperture yellowish, and there is a faint yellowish band beneath the suture. The protoconch is deep reddish and minutely pitted. This coloration is unusual and possibly due to these specimens (the types) being from deep water (type locality Foveaux Strait). Specimens from the littoral zone are dark reddish brown to dark chocolate, with the body whorl slightly paler. There is never any sculpture, the surface being smooth and shining, with very faint growth lines only. The only variation is in relative width (cf. figs. 5 and 6).

**Lectotype:** (Fig. 5). Foveaux Strait (G.S.).

Height 1.55 mm. Width 0.7 mm.

**Animal:** (Portobello). Semi-transparent—white externally, with a moderately long snout, fairly long tentacles with swollen ends, but flattened dorso-ventrally, ciliated on the ventral side and with motionless setae on the distal half.

**Material Examined:**

Lectotype and paralectotypes; Bushey Beach, Oamaru, W. Ballantine, 24/2/64 (W.F.P.); Portobello, Dunedin Harbour, in coralline algae, 3/9/63 (W.F.P.); Ships' Channel side of Quarantine Island, Dunedin Harbour, in coralline algae, 4/9/63 (W.F.P.); Taieri Beach, Finlay Coll. (A.M.); Middle Grounds, Foveaux Strait, 15-30 fathoms, -/6/51, O. Allan (D.M.); Bathing Beach, Stewart Island, O. Allan, 1950 (D.M.); Mason's Bay, Stewart Island, R. H. Harrison (A.M.) and O. Allan, -/8/48 (D.M.); Doubtful Sound in 50 fathoms (W.F.P.); B.S. 185, Casewell Sound, 10 fathoms, R. K. Dell, 23/3/49 (D.M.); Faith Harbour, Auckland Islands (Powell Coll.); Ewing Island, Port Ross, Auckland Islands, Cape Expedition (A.M.); Waitangi, Chatham Islands, shell sand (Powell Coll.); Waitangi, algae between tides, W. R. B. Oliver, -/12/09 (D.M.); Chatham Island Exped. Stat. 38, 43 fathoms South of Little Mangere, 2/2/54 M.V. "Alert" (D.M.); Chatham Islands Exped. Stat. 16, Kaingaroa, shell sand, 27/1/54 (D.M.); in shell sand, Port Hutt, Chatham Islands, 8/2/54 (D.M.); Chatham Islands Exped. Stn. 2, 42° 59.4' S., 175° 304' E., Mernoo Bank, 61 fathoms, 23/1/54 (D.M.). *Subfossils* Motunau Raised Beach, Hawera series (Upper Pleistocene) (G.S.).

**Distribution:** The far South of the South Island, Auckland Islands and Chatham Islands in the littoral zone and deep water.

***Estea* aff. *minor* (Suter).** Plate 18, fig. 7.

A single specimen related to *minor* (Suter) from Waimumu has a taller spire than recent specimens (1.9 x 0.775 mm.).



**Material Examined:** Waimumu S.D. (Duntroonian-Waitakian) (G.S.).

**Remarks:** The antiquity of this specimen, together with the differences in shell characters, suggest this is a subspecific forerunner of *minor*. However insufficient material is available for a name to be applied. *E. minor* is not recorded as a fossil, and no related species connect these two forms.

**Estea missile** Laws. Plate 19, fig. 5.

1940 *Estea missile* Laws, Trans. Roy. Soc. N.Z., 70, p. 50, pl. 5, fig. 11.

This rather small shell is a very distinctive species with its rather tall spire, which has a slightly convex outline and moderately expanded aperture. Most distinctive of all, it is smooth with a prominent supra-sutural channel developed on the adult whorls and, weakly, across the periphery. It is not closely related to any other species.

**Holotype:** (Fig. 5). Mangapani, Taranaki (Upper Waitotaran) (G.S.).

Height 2.025 mm.      Width 0.9 mm.

**Material Examined:** Holotype and two paratypes; Nukumarū Brown Sands, (Nukumaruan) (G.S. and Geol. Dept. A.U.) Ohope, (Castlecliffian) Laws Col. (Geol. Dept. A.U.).

**Distribution:** Upper Waitotaran Pliocene to Castlecliffian, Pleistocene.

**Estea polysulcata** Finlay. Plate 20, fig. 5.

1924 *Estea polysulcata* Finlay, Trans. N.Z. Inst. 55, pp. 486-487, fig. 8.

This is a little-known species very close to *E. rugosa* (Hutton) and *E. semisulcata* (Hutton), but differing in having more numerous spiral cords. All specimens seen were in poor condition, but there seemed to be no axial sculpture developed. The holotype has 9 strong, unequally developed, spirals on the body whorl above the periphery, and 5 faint spirals on the base. The interstices are generally narrow, and the spiral cords low. The spire whorls have about 6 faint spirals in other specimens examined (the holotype has the spire badly worn). The spire is rather tall with slightly convex outlines, and the whorls are faintly convex and cut in below at the sutures. The aperture was not fully developed in any specimens examined. The holotype is immature with the inner lip a thin glaze only, and the outer lip thin and sharp.

**Holotype:** (Fig. 5). Maraekakaho Creek (3 miles above junction with Ngaruroro River, Geol. Surv. loc. 1102), (Nukumaruan) (G.S.).

Height 3.6 mm. (estimated)      Width 1.6 mm. (estimated)

**Paratype:** (Not examined) Nukumarū.

**Material Examined:** Holotype; Hunterville, Turakino Road (Nukumaruan) (G.S.).

**Distribution:** Nukumaruan, lower Pleistocene.

**Estea praecidecosta** n. sp. Plate 21, fig. 8.

Shell large for genus, axially ribbed, solid, ovate-conical, outlines of spire very lightly convex, brown. Whorls  $5\frac{3}{4}$ , very lightly convex, cut

in at sutures; protoconch  $1\frac{3}{4}$  whorls, dome-shaped, very finely sculptured with minute punctures in numerous spiral series, terminated by weak varix. Sculpture of straight or slightly oblique strong axials, about 22 on penultimate. A faint spiral subsutural and suprasutural swelling, but no true cord. An incised spiral line on periphery of body whorl abruptly terminates axials. Axials obsolete over last quarter of body whorl. Base with fine axial ribs crossed by weak spiral scratches. Apertural oval, small; columella thick, separated from base, white. Inner lip wide, outer lip with a wide, shallow, anterior sinus, thickened above, rather thin below, sharp edged, white. Colour uniform brown. The axials vary in strength, sometimes becoming almost obsolete. Differs from *E. manawatawhia* in size, number of axials, colour, and the termination of the axials at the periphery. Animal unknown.

**Holotype:** (Fig. 8). N.Z.O.I. Stat. C. 760, off Three Kings Islands,  $34^{\circ} 10.8' S.$ ,  $172^{\circ} 8.4' E.$ , 44 fathoms, bryozoan substrate, 18/2/62 (O.I.).

Height 3.7 mm.

Width 1.775 mm.

**Paratypes:** New Zealand Oceanographic Institute, Auckland and Dominion Museums.

#### Material Examined:

Holotype and paratypes; Discovery II Stat. 932, off Three Kings Islands, 185 metres (among paratypes of *E. manawatawhia*) (Powell Coll.); Discovery II Stat. 92, 59 metres, off Spirits Bay (Powell Coll.); 50 fathoms, between Cape Maria van Diemen and Three Kings Island, 1961 (Hipkins Coll.).

#### *Estea rekohuana rekohuana* Powell. Plate 18, figs. 8-10.

1924 *Rissoa subfusca* Odhner (not of Hutton), N.Z. Moll. Pap. Mortensen Pacific Exped. p. 22.

1928 *Estea* n. sp. aff. *minor* Finlay, Trans. N.Z. Inst., 59, p. 242.

1933 *Estea rekohuana* Powell, Rec. Auck. Inst. Mus. 1 (4), p. 199, pl. 35, fig. 9.

1955 *Estea rekohuana* Powell; Powell, D.S.I.R. Cape Exped. Series, Bull., 15, p. 84.

Though rather similar to *E. zosterophila*, *E. rekohuana* is easily distinguished by its larger and heavier shell. The colour and adult size tend to be fairly variable. Specimens collected alive from the type locality (Waitangi, Chatham Islands) and agreeing closely with the type, have the spire varying from dark reddish- or purplish-brown to dark yellowish-brown, often with a whitish subsutural band which is variable in width. The aperture is pale yellowish-brown, except for a brown blotch on the columella, and the base may be the same colour as the spire, or paler. The protoconch is dark red in colour and sculptured with many minutely punctuate, fine, spiral lines. Stewart Island specimens (fig. 10) are often taller and larger than shells from other localities, pinker in colour, and with more obvious white bands, but these differences are by no means constant. Shells from the Auckland and Antipodes Islands (fig. 9) are often broader than the majority of specimens examined, but again, this is not a constant feature. Shells from most other localities agree well with the type series. However, at the northern end of the range of this subspecies (Cape Runaway), are found more elongate, dark reddish shells, with a yellowish-brown body whorl, white aperture, and faint subsutural pale bands. They are close to a yet taller form found North of East Cape, which is separated as a subspecies. The holotype (fig. 8) is slightly distorted owing to fractures



on the third and fourth whorls which have caused a narrow step below the suture on the third whorl, and make the shell a little lopsided.

**Animal:** (Portobello, Dunedin). General colour externally dark grey owing to black pigment cells scattered over surface, but ground colour white. Sole dense white and opercular lobes dark grey. Tentacles club-shaped, compressed, transparent with a 'dusting' of black pigment on anterior and posterior edges, with active cilia on ventral edge, longer immobile cilia terminally.

**Holotype:** (Fig. 8). Waitangi, under stones, A. W. B. Powell, -/2/33 (A.M.).

Height 2.0 mm.

Width 1.875 mm.

### Material Examined:

Holotype and paratypes; Cape Runaway, under stones, A. W. B. Powell, -/8/33 (Powell Coll.); Tolaga Bay, R. K. Dell (D.M.); Wainui Beach, Gisborne, Laws Coll. (Geol. Dept. A.U.); Gisborne, shell sand, 1906 (D.M.); Kaiti Beach, Gisborne, R. K. Dell, 26/11/50 (D.M.); Island Bay, Wellington, under stones, A. W. B. Powell (Powell Coll.) and shell sand, 2/10/56 (W.F.P.); Lyall Bay, Wellington, Finlay Coll. (A.M.); Lyall Bay, shell sand (W.F.P. and D.M.); Point Howard, Wellington Harbour (W.F.P.); Seatoun, Wellington, R. K. Dell (D.M.); Makara Beach, M. Mestayer, 26/8/26 (D.M.); Titahi Bay (D.M., G.S. and W.F.P.); Paremata Harbour (W.F.P.); Cape Campbell, *Corallina*, 16/2/64, W. Ballantine (W.F.P.); Mudstone Bay, Kaikoura, *Corallina*, R. A. Rasmussen, 12/6/64 (W.F.P.); Shark's Tooth Reef, Kaikoura, under stones, P. Luckens, 12/8/64 (W.F.P.); Oaro, South of Kaikoura, coralline algae, W. Ballantine, 19/2/64, (W.F.P.); Lyttelton and Te Onepoto, Suter Coll. (G.S.); Akaroa, Laws Coll. (Geol. Dept. A.U.); Wainui, Akaroa, under stones, A. W. B. Powell (Powell Coll.); East of Diamond Harbour, Lyttelton Harbour, *Corallina*, under stones, -/8/63 (W.F.P.); Pile Bay, Lyttelton Harbour, Dell Coll. (D.M.); Purau, Lyttelton Harbour, shell sand, W. R. B. Oliver, 1/1/07 (D.M.); Taylor's Mistake, Bank's Peninsula, soft coralline algae in rock pools, W. R. B. Oliver, 10/4/10 (D.M.); Timaru, W. R. B. Oliver, -/2/07 (D.M.); Bushey Beach, Oamaru, coralline algae, W. Ballantine, 24/1/64 (W.F.P.); Moeraki, Finlay Coll. (A.M.); Warrington, Dunedin, Laws Coll. (Geol. Dept. A.U.); Dunedin Harbour, 3 fathoms (Powell Coll.); Portobello, Dunedin Harbour, Finlay Coll. (A.M.) and *Corallina*, under stones, 3/9/63 (W.F.P.); off Wharf, Portobello, 2-3 fathoms, 3/9/63 (W.F.P.); Little Papanui, Dunedin, under stones in contact with sand, 3/9/63 (W.F.P.); Taieri Beach, Finlay Coll. (A.M.); Bluff Harbour, in *Corallina*, M. Spong, 27/5/63 (W.F.P.); Halfmoon Bay, Stewart Island, E. Smith (Powell Coll.), under stones, R. K. Dell, 30/10/48 (D.M.) and under stones, M. Spong, -/3/63 (W.F.P.); Aker's Point, Halfmoon Bay, under stones, M. Spong, 22/2/63 (W.F.P.); Bathing Beach, Stewart Island, O. Allan, 1950 (D.M.); Mason's Bay, Stewart Island, O. Allan, -/8/48 (D.M.); Ulva Island, Paterson Inlet, O. Allan, 1949 (D.M.); B.S. 104, Chalky Inlet, 20 fathoms, M.V. "Alert", W. H. Dawbin, 6/5/50 (D.M.); B.S. 137, off Passage Point, Dusky Sound, 12-15 fathoms, M.V. "Alert", W. H. Dawbin, 8/1/52 (D.M.); B.S. 107, Gaol Passage, Doubtful Sound, 25 fathoms, M.V. "Alert", W. H. Dawbin, 8/5/50 (D.M.); B.S. 185, Casewell Sound, 10 fathoms, R. K. Dell, M.V. "Alert" (D.M.); B.S. 110, inside entrance to George Sound, 15-20 fathoms, M.V. "Alert", W. H. Dawbin, 10/5/50 (D.M.); Snares Islands, 50 fathoms, Finlay Coll. (dead shells) (A.M.); Carnley Harbour, Auckland Islands, 6 fathoms (G.S.) and J. Sorensen, -/4/47 (D.M.); Auckland Islands, 6 fathoms (A.M.); Ewing Island, Port Ross, Auckland Islands, Cape Exped. (A.M.); Emergency Bay, Auckland Islands, 6 fathoms (A.M.); Auckland Islands, Finlay Coll. (A.M.); off Leeward Island, Antipodes Islands, 15 fathoms, R. K. Dell, -/11/50 (D.M.); Ringdove Bay, Antipodes Islands, under stones, R. K. Dell, -/11/50 (D.M.); Waitangi, Chatham Islands, shell sand (G.S., A.M., Geol. Dept. (A.U.); Waitangi, in pools, on algae, under stones, W.R.B. Oliver, 8/12/09 (D.M.); Chatham Islands, Exped. Stat. 32, off Waitangi, 7 fathoms, M.V. "Alert", 31/1/54 (D.M.); Port Hutt, Chatham Islands, shell sand; 8/2/54, (Chatham Islands Exped.) (D.M.); Red Bluff, Chatham Island, W. R. B. Oliver, 6/12/09 (D.M.); Tioriori, Chatham



Islands, Dell. Coll. (D.M.); Chatham Islands Exped. Stat. 16, Kaingaroa, shell sand, 27/1/54 (D.M.); Chatham Islands Exped. Stat. 38, South of Little Mangere, 43 fathoms, M.V. "Alert", 2/2/54 (dead shells) (D.M.); Chatham Islands Exped. Stat. 13, off Owenga, 4-6 fathoms, 27/1/54 (D.M.). *Subfossil*: Motunau Raised Beach (Hawera Series) (Upper Pleistocene) (G.S.).

**Distribution:** South of East Cape and the Wellington West Coast (but probably extending further North), and the East (and West?) coasts of the South Island, Stewart Island, Fiordland, Snares, Auckland, Antipodes and Chatham Islands, typically living in the littoral zone.

**Ecology:** In the northern part of its range, *E. rekohuana* lives under stones on the lower part of the shore, while *E. zosterophila* is found in coralline algae. Further south *E. rekohuana* completely replaces *E. zosterophila*, and is found in coralline algae, under stones and occasionally living on brown algae. Thus it occupies the same habitats as does *E. zosterophila* in the northern part of the North Island.

***Estea rekohuana lactorubra* n. subsp.** Pl. 17, figs. 10, 11; Pl. 18, fig. 11.

Shell rather large for genus, spire slightly convex, whorls lightly convex. Protoconch of two whorls, dome-shaped, with about 20 fine spiral series of punctures, dark red in colour and terminated by a very weak varix. Adult whorls smooth, except for weak growth lines, sutures weakly impressed. Spire reddish, with a milk-white band below the suture in fresh specimens but this tending to become obscure when dried; body whorl yellowish white, except for a brown blotch just behind the aperture which is a remnant of a wide, brown, basal spiral, (better developed in some paratypes), which is faint in the holotype. A brown blotch on inner lip. Aperture typical of genus, moderately large, slightly angled above. Periphery and base evenly rounded.

The new subspecies differs from *E. rekohuana rekohuana* in having a proportionately longer spire and a rather different colour pattern. There is some relationship with *E. zosterophila* shown by the shape and the presence of a basal spiral band, but it differs from that species in being of a larger size, and having a paler colour pattern in which the basic colour is red rather than brown. The relative size of the aperture also separates it from *zosterophila*, but relates it to *rekohuana*, as does the general coloration. On consideration of the distribution and relationships of the forms involved, it seems best considered to be a subspecies of *rekohuana*.

**Animal:** Very similar to *E. zosterophila*. Colour of exposed animal largely grey, because of scattered black pigment cells in the integument. Cephalic tentacles transparent white, the sole dense white. Snout greyish, the tip unpigmented and bilobed; buccal mass dark grey. Short posteriorly beating, cilia on ventral sides of rather short club-shaped, flattened, cephalic tentacles, while rather long stationary cilia are situated distally. Eyes moderately large, on swellings at outer bases of tentacles. An unpigmented, ciliated groove extends down right side of animal on to side of foot. Foot rather long, anterior end rounded, mucous slit extending from middle region of sole to posterior end. Penis (pl. 17, fig. 10) long and slender, coiled behind head in about 1½ coils, tip tapered to a sharp point.

The animal removed from its shell is seen to have a similar arrangement of the organs as those of *E. zosterophila*.

**Operculum:** (Pl. 17, fig. 11). Similar to *E. zosterophila*. Oval, columella marginal area rather wide, outer marginal area indistinct. Muscle insertion area distinct, marked with faint, irregular lines.

**Radula:** Very similar to *E. zosterophila* in tooth shape and cusp formula.

**Holotype:** (Pl. 18, fig. 11). Smugglers' Bay, Whangarei Heads, under stones embedded in sand in rock pools at low tide, W.F.P., 6/5/62 (A.M.).

Height 3.125 mm.

Width 1.45 mm.

**Paratypes:** Auckland, Dominion and Canterbury Museums, N.Z. Geological Survey, Lower Hutt.

### Material Examined:

Holotype and paratypes; Spirits Bay, shell sand (Hipkins Coll.); Waiau Beach, Manganui, shell sand, E. R. Richardson, 11/12/50 (D.M.); Taupo Bay, Whangaroa, shell sand, E. R. Richardson, 11/4/51 (D.M.); Tapeka Point, Russell, -/1/52 (Hipkins Coll.) and 8/1/39, R. K. Dell (D.M.); Peach Cove, Whangarei Heads (Powell Coll.); Smugglers Bay, Whangarei Heads, under stones, -/5/63 (W.F.P.); Poor Knights Islands, under stones in rock pools, 4/4/64 (W.F.P.); Bream Tail, under stones, 12/8/63 (W.F.P.); Laing's Beach, Mangawai, shell sand, (Hipkins Coll.); Okupu, Great Barrier Island, under stones, -/11/63 (W.F.P.); Goat Island Bay, Leigh, under stones (Hipkins Coll. and W.F.P.); Noises Islands, G. Sadler (Powell Coll.); Motutapu Island, under smooth stones at half tide (Powell Coll.); Tawharanui Point, North side, under stones on papa platform, 31/12/63 (W.F.P.); Jackson's Bay, Coromandel Peninsula, under stones, 29/3/64 (W.F.P.).

**Distribution:** The North East of the North Island under stones in the littoral zone.

**Ecology:** This subspecies prefers open coasts and has never been found anywhere but under stones in the lower littoral zone. These may be embedded in sand or resting on coarser material, but *E.r. lactorubra* is not commonly found on stones with many encrusting organisms on the under surface. Papa rock platforms and rock pools are the most favoured localities.

### *Estea rekominor rekominor* Laws. Plate 21, fig. 12.

1940 *Estea rekominor* Laws, Trans. Roy. Soc. N.Z., 70, p. 50, pl. 6, fig. 15.

The shell of this species is smooth, with a distinctly D-shaped aperture, the inner lip of which is nearly horizontal. The only sculpture is of growth lines, but in some paratypes axial growth striae are moderately strong on the last half of the body whorl. All of the paratypes are very similar though a few are slightly more slender than the holotype. The protoconch is finely punctate as in other members of the genus.

**Holotype:** (Fig. 12). Nukumarū, South Taranaki (Nukumaruan) (G.S.).

Height 2 mm.

Width 1.025 mm.

**Material Examined:** Holotype and paratypes. Nukumarū Brown Sands (G.S.).

**Distribution:** Nukumaruan, lower Pleistocene.

***Estea rekominor cadus* Laws.** Plate 21, figs. 13, 13a.

1950 *Estea cadus* Laws, N.Z. G.S. Pal. Bull., 17, p. 20, pl. 2, fig. 11.

This subspecies is very close to *E.r. rekominor* in shape and has the same type of aperture with a nearly horizontal inner lip. In the holotype there are low, rather irregular axials developed on back of the body whorl, the last quarter being smooth. Apparently only strongly developed growth rugae, they occur in approximately the same frequency as the striae on the spire whorls. Most paratypes develop the axials at the beginning of the body whorl, which is smooth over the last third. There is a weak subsutural cord on the last  $1\frac{1}{2}$  whorls.

Some specimens of *E.r. rekominor* develop weak axial rugae, while *E.r. cadus* is occasionally nearly smooth. *Cadus* is usually a little smaller than *rekominor*, but the two subspecies are obviously very closely related.

**Holotype:** (Fig. 13). Otahuhu Well (Opoitian) (G.S.).

Height 1.6 mm. Width 0.875 mm.

**Material Examined:** Holotype and paratypes.

**Distribution:** Opoitian, lower Pliocene.

***Estea rufoapicata* (Suter).** Plate 20, figs. 6-8.

1908 *Rissoa rufoapicata* Suter, Proc. Malac. Soc. London 8, p. 28, pl. 2, fig. 21.

1913 *Rissoa (Rissoa) rufoapicata* Suter; Suter, Man. N.Z. Moll. p. 201, pl. 12, fig. 4.

1915 *Estea rufoapicata* (Suter); Iredale, Trans. N.Z. Inst. 47, p. 454.

1955 *Estea rufoapicata* (Suter); Powell, D.S.I.R. Cape Exped. Series Bull., 15, p. 63, fig. 79.

1956 *Estea rufoapicata rufoapicata* (Suter); Dell, Dom. Mus. Bull., 18, p. 63, fig. 79.

1956 *Estea rufoapicata latior* Dell, Dom. Mus. Bull., 18, p. 63, fig. 82.

*E. rufoapicata* is a handsome southern species with irregular axial ribs, which are variably developed in strength and number. In the lectotype the last four whorls have weak, rounded axials, and the reddish protoconch is minutely pitted in spiral series. The first two adult whorls are reddish, with a narrow white band below the suture, while the third whorl is purplish and the body whorl white.

Dell's "subspecies" *latior* is a large finely sculptured form while his 'typical' *rufoapicata* from the Chatham Islands is a small form with few, strong axials (Dell 1956, fig. 79). The lectotype and some paralectotypes of *E. rufoapicata* are intermediate between these extremes, while other paralectotypes are indistinguishable from some paratypes of *latior*. Specimens sometimes attain a height of over 4 mm. (fig. 8).

**Lectotype:** 50 fathoms, Snares Islands (G.S.).

Height 3.6 mm. Width 1.6 mm.

**Material Examined:**

Lectotype and paralectotypes; 60 miles East of Lyttelton, 100 fathoms (Powell Coll.); B.S. 190, 45° 45.4' S., 171° 5' E., off East Otago Coast, Canyon C., in 300 fathoms, M.V. "Alert", 16/8/55 (types of *latior*) (D.M.); 60 fathoms off Otago Heads (Finlay Coll.) (A.M.) and (G.S.); 72 fathoms off Cape Saunders,



Otago, Laws Coll. (A.M.); 170 fathoms off Puysegur Point (Powell Coll.); Portobello "Alert" Station 54-17, Canyon A, E.N.E. of Taiaroa Heads, 260-350 fathoms, 28/3/54 (D.M.); 50 fathoms, Snares Islands, Finlay Coll. (A.M. and D.M.); Chatham Islands Exped. Stat. 34, 44° 04' S., 175° 23.5' E., East of Forty Fours, 130 fathoms (D.M.).

**Distribution:** The South East and South of the South Island, the Snares Islands and the Chatham Islands, in deep water.

***Estea rugosa* (Hutton). Plate 20, fig. 4.**

1885 *Rissoa rugosa* Hutton, Trans. N.Z. Inst., 17 (1884-85), p. 321.

1893 *Rissoa rugosa* Hutton; Hutton, Macleay Mem. Vol., Plioc. Moll. p. 65, pl. 8, fig. 66.

1915 *Rissoa (Alvania) rugosa* Hutton; Suter, G.S. Bull., 3, p. 5.

1924 *Estea rugosa* (Hutton); Finlay, Trans. N.Z. Inst., 55, p. 487.

The lectotype (fig. 4) is a large shell with the first  $3\frac{1}{2}$  adult whorls strongly axially sculptured, but there are only traces of axials crossing the much stronger spiral cords on the body whorl. There is a spiral groove cutting off the top portion of the axials on all the whorls except the first. This gives the appearance of a nodulose spiral cord below the sutures on the spire whorls, though this cord is nearly smooth on the body whorl. On all the whorls there is a fairly wide smooth groove above the suture. The axials extend into this groove on the last part of the antepenultimate, forming a nodulose spiral rib above the suture, and a second is added on the penultimate. There are two weak spiral grooves which pass over the first part of the penultimate in the lower half of the whorl. These become stronger and form spiral cords on the body whorl. Thus on the body whorl there are 5 spiral cords, the second and third being the weakest. The base is nearly smooth with only traces of spiral sculpture. The protoconch consists of  $1\frac{3}{4}$  whorls, and is moderately tall, with many, minutely punctate, spiral lines. The spire is slightly convex, while the whorls are very lightly convex and cut in at the sutures. The aperture is ovate, and angled posteriorly, and the peristome is thickened as in other *Estea* species.

Some paralectotypes show slight variation from the lectotype, having 6 main spiral cords on the body whorl and 3 weak ones on the base. Others have moderately strong axials developed on the body whorl. Most other specimens seen were a little smaller than the lectotype.

**Lectotype:** (Fig. 4). (Chosen by H. Suter). Petane (Nukumaruan) (Cant. Mus.).

Height 4.3 mm.

Width 1.75 mm.

**Material Examined:** Lectotype and paralectotypes; Pohangina (Dunroonian) Laws Coll. (Geol. Dept. A.U.); Wilkes Bluff (Waitotaran) Laws Coll. (Geol. Dept. A.U.); Wilkes Bluff (Waitotaran) Laws Coll. (Geol. Dept. A.U.); Nukumaruan (Nukumaruan) Laws Coll. (Geol. Dept. A.U.); Onga Onga Road, Hawkes Bay, (Nukumaruan) (G.S.); Petone (Nukumaruan) (G.S.).

**Distribution:** Dunroonian, lower Oligocene to Nukumaruan, lower Pleistocene.

This species is interesting in showing an intermediate condition between the axially and spirally sculptured species of *Estea*. It is closely related to *E. semisulcata* (Hutton) and *E. polysulcata* Finlay, but bears

little resemblance to the typical axially-ribbed *Estea* species such as *E. impressa*.

***Estea semiplicata* Powell. Pl. 17, figs, 5, 6; Pl. 21, fig. 10.**

1927 *Estea semiplicata* Powell, Trans. N.Z. Inst., 57, p. 543, pl. 28, fig. 17.

*E. semiplicata* can be identified by the rather strong ribs on the penultimate and body whorl; the moderately large size, and the dark brown coloration. The spire is conical and slightly convex to nearly straight, with broad axial folds developed on the body whorl and the last part of the penultimate whorl. The spire whorls are typically fairly smooth but weak axial growth rugae do develop in many specimens.

There is considerable variation in width and coloration. All the shells are varying shades of brown, but the narrow form, like the holotype, usually has a wide yellow band, while in the broader form the band is either narrow or absent.

Intermediate forms do occur in a few localities, but I have never found the broad and narrow varieties living together, though they are found together as dead shells in shell sand (e.g. Tryphena, and Smugglers Bay). The broad form lives in compact *Corallina* in fairly sheltered, silted conditions, while the narrow shells are typically found living in exposed, clean situations, usually living on short algae. However there is no evidence to indicate that the two forms should be separated. Occasional evidence of hybridization with *E. zosterophila* is seen (see p. 133).

**Animal:** External pigmentation dark grey to nearly black, rather more heavily pigmented than other species of the genus. Snout dark grey, bilobed, short; buccal mass black. Sole white, with a mucous slit extending from centre to posterior edge. Cephalic tentacles short, club-shaped, with active cilia on ventral surface, long stationary cilia distally. Eyes moderately large, on slight swellings at outer bases of tentacles, with a group of white gland cells behind. Penis (pl. 17, fig. 6) thick, wide, coiled about  $1\frac{1}{2}$  times, tip sharply pointed. The anatomy is described elsewhere (Ponder—a).

**Operculum:** Very similar to that of *E. rekohuana lactorubra* n. subsp.

**Radula:** (Pl. 17, fig. 5). As in *E. zosterophila* but lateral cusp formula  $2 + 1 + 2$ , and outer marginal with larger denticles (about 9) than the inner (about 11).

**Holotype:** Taupo Bay, Whangaroa (Powell Coll.).

Height 2.375 mm.

Width 1.15 mm.

**Material Examined:**

Holotype and paratypes; between Cape Maria van Diemen Island and mainland, 4 fathoms, -/2/61 (Hipkins Coll.); Spirits Bay, shell sand, (Hipkins Coll.); Kapuwairua, Spirits Bay, -/1/57 (Powell Coll.); Parengarenga, Laws Coll. (Geol. Dept. A.U. and G.S.); Waiau Beach, Mangonui, E. R. Richardson, 11/12/50 (D.M.); Whatuwhiwho, Doubtless Bay, under stones (Hipkins Coll.); Taupo Bay, Whangaroa, shell sand, E. R. Richardson, 11/4/51 (D.M.); off Reach Island, Whangaroa,  $4\frac{1}{2}$  fathoms (W.F.P.); Cavalli Islands, Whangaroa, algae, -/6/52 (D.M.); Tapeka Point, Russell, Bay of Islands, -/1/52 (Hipkins Coll.); off Russell, 8 fathoms, R. K. Dell, -/1/39 (D.M.); Whangaruru (W.F.P.); Smugglers Bay, Whangarei Heads, shell sand, short red algae, 5/5/62 (W.F.P.); Ocean Beach, Whangarei Heads, *Carpophyllum plumosum*, short algae, 7/5/62 (W.F.P.);

Taurikura Bay, Whangarei Heads, coralline algae, under stones, -/5/63 (W.F.P.); dredged off Mokohinau Islands (dead shells) (W.F.P.); Okupu, Great Barrier Island, under stones, -/11/63 (W.F.P.); off Great Barrier Island, 8-10 fathoms, Dell Coll. (D.M.); Whangaparapara, Great Barrier Island, on reef, R. K. Dell, Dell Coll. (D.M.); Tryphena, Great Barrier Island (Geol. Dept. A.U., Hipkins Coll., G.S.) and 6-10 fathoms (G.S.); Goat Island Bay, Leigh (W.F.P.); Leigh, Dell Coll. (D.M.); Noises Islands, G. Sadler (Powell Coll.); Jackson's Bay, Coromandel, coralline algae, *Carpophyllum plumosum*, fine red algae, 29/3/64 (W.F.P.); Stony Bay, Coromandel, in coralline and other short algae growing on boulders, 28/3/64 (W.F.P.); Mayor Island, 35-80 fathoms (Powell Coll.); Cape Runaway, (A.M.).

*Fossil*: Otahuhu Well, (Opoitian) Laws Coll. (Geol. Dept. A.U.), (1 juvenile); Te Piki (Castlecliffian) Laws Coll. (Geol. Dept. A.U.).

**Distribution:** Opoitian to recent. The present geographical distribution is the North East of the North Island in the littoral zone and extending into a few fathoms.

**Ecology:** *E. semiplicata* lives on coralline and other short algae, and under stones in the littoral zone. At Taurikura Bay, Whangarei Heads, *Corallina* samples were taken from various points around a small island just offshore (High Island), which indicated that marked changes occurred in the local distribution of *E. semiplicata*. On the sheltered, shore-facing side of the island, the "broad form" was very abundant, together with the rissoinid "*Austronoba*" *carcosa* (Webster), while on the more exposed outer side, *E. zosterophila* was the most abundant mollusc.

**Remarks:** The Australian *E. salebrosa* Frauenfeld, is very similar in build and texture to *E. semiplicata*, but differs in details of size, shape and sculpture. Iredale (1955) has provided the genus *Feldestea* for this species. However *E. semiplicata* has many points in common with the type of *Estea* and there is even evidence of occasional interbreeding between these two species. Shell sculpture is not a good guide to relationship in *Estea*, and any related genera or subgenera that are based primarily on sculpture alone, should be regarded rather doubtfully. There appears to be no good reason to retain *Feldestea* as a subgenus, let alone a full genus. Coan (1964) places *Feldestea* in the subfamily Rissoinae, while he puts *Estea* in his Cingulinae. This is a good example of the over-emphasis placed on shell sculpture in the *rissoids*. *Estea semiplicata* belongs to a different line from *E. impressa* (Hutton), while *E. rufoapicata* (Suter) and *E. manawatawhia* Powell, also belong to independent lines which have developed axial ribs.

***Estea semisulcata* (Hutton).** Plate 20, figs. 1-3.

1885 *Rissoa semisulcata* Hutton, Trans. N.Z. Inst., 27, p. 301.

1893 *Rissoa semisulcata*, Hutton; Hutton, Macleay Mem. Vol., Plioc. Moll., p. 66, pl. 8, fig. 69.

1915 *Rissoa (Onoba) semisulcata* Hutton; Suter, N.Z. Geol. Surv. Pal. Bull. 3, p. 5.

1924 *Estea semisulcata* (Hutton); Finlay, Trans. N.Z. Inst., 55, p. 487.

1934 *Estea semisulcata* (Hutton); Powell, Trans. Roy. Soc. N.Z., 64, p. 155.

The species is characterised by the smooth spire and the strong spiral cords developed on the body whorl. The number of spirals is fairly constant, usually being 5 on the body whorl, but small shells often have only 4. The spirals commence on about the last quarter of the penultimate whorl in the majority of specimens, but this does vary somewhat, especially between populations. In some (e.g. Turakina Road,



Hunterville) the spirals commence after the first third of the penultimate whorl, while in recent specimens from off Whangaroa there are fine spiral cords on all adult whorls except the first. The strength of the spiral cords is usually fairly constant, being low, broad, and rounded, with narrow interstices, though these are much weaker in occasional specimens (e.g. a few shells from Castlecliff have the spirals subobsolete, even on the body whorl). Specimens from off Whangaroa show weaker cords and rather wider interstices than most fossils.

The species shows a considerable range of variation in size and development of the spiral sculpture on the spiral whorls. Powell (1934) recorded it living in the North, and recent specimens seem to be even more variable than fossils. Specimens from off Whangaroa (fig. 3) are rather different from most fossils seen, whereas those from certain other recent localities are inseparable from typical fossils. The lectotype is rather larger than normal, while all the paralectotypes are smaller (fig. 2). The colour of recent specimens (Whangaroa) is dark brown, reddish-brown, or orange-red, and the protoconch is dark red to orange red, the columellar is red to pale yellowish, and the rest of the aperture is white. The base is lighter in colour than the rest of the body whorl, usually being pale yellow-orange.

**Lectotype:** (Fig. 1). (Chosen by H. Suter). Wanganui (Pleistocene) (Cant. Mus.).

Height 3.7 mm.

Width 1.7 mm.

### Material Examined:

*Fossil* Lectotype and paralectotypes; Otahuhu Well (Opoitian) Laws Coll. (Geol. Dept. A.U.); Wilkies Bluff (Waitotaran) Laws Coll. (Geol. Dept. A.U.); Mangapani (Waitotaran) Laws Coll. (Geol. Dept. A.U.); Nukumarū Brown Sands (Nukumaruan) (G.S.); Nukumarū (Nukumaruan) Laws Coll. (Geol. Dept. A.U.); Hunterville, Turakino Road, (Nukumaruan) (G.S.); Takapau S.D. (Nukumaruan) (G.S.); Mangaotero S.D. (Nukumaruan) (G.S.); Castlecliff (Castlecliffian?) Laws Coll. (Geol. Dept. A.U.); Castlecliff (Castlecliffian) (G.S.); Castlecliff 'B' (Castlecliffian) (G.S.); Waikopiro Wanganui (Castlecliffian?) (locality uncertain) (G.S.). *Recent*: 22 fathoms,  $\frac{1}{2}$  mile South of Stephenson's Island, 3 $\frac{1}{2}$  miles off Whangaroa (Hipkins Coll.); Off Little Barrier, 20 fathoms (Powell Coll.); 6-10 fathoms, off West Coast of Great Barrier Island (Powell Coll.); 46-82 fathoms, N.N.E. of Mayor Island, in fish stomach contents, Coll. G. Gilliams (Powell Coll.); 50 fathoms, off South West end of Mayor Island, in fish stomach contents, Coll. G. Williams (Powell Coll.).

**Distribution:** Opoitian to Recent. The recent distribution is in moderately deep water in the North East of the North Island.

***Estea subfusca* (Hutton).** Pl. 17, figs. 12, 13; Pl. 18, figs. 12-16.

1873 *Rissoa subfusca* Hutton, Cat. Mar. Moll., p. 28.

1909 *Rissoa* (*Cingula*) *subfusca* Hutton; Suter, Subantarctic Is., N.Z. 1, p. 17.

1913 *Rissoa* (*Cingula*) *subfusca* Hutton; Suter, Man. N.Z. Moll., p. 210, pl. 12, fig. 18.

1915 *Estea subfusca* (Hutton); Iredale, Trans. N.Z. Inst. 47, p. 454.

1928 *Estea* sp. of *zosterophila* Finlay, Trans. N.Z. Inst. 59, p. 242.

1933 *Estea subfusca* (Hutton); Powell, Rec. Auck. Inst. Mus. 1 (4), p. 200, pl. 35, fig. 7 (topotype).

1933 *Estea guesti* Powell, Rec. Auck. Inst. Mus. 1 (4), p. 200, pl. 35, fig. 5.

1955 *Estea subfusca* (Hutton); Powell, Cape Exped. Series Bull. 15, p. 84.

This species can be distinguished by its large size, straight-sided spire, smooth, shining surface and subangled periphery.

There is considerable variation in size, outline, angulation of the periphery and colour (c.f. figs. 12, 14, 15 and 16). Some of this is geographic, at least in part, but most of the variation is within populations. The shell may be unicoloured purplish, dark or light brown, or yellowish, or may have lighter bands below the suture. The base may be coloured the same as the spire or much more darkly, and this dark colour is often cut off sharply at the periphery (especially typical of Chatham Island shells). The protoconch varies from dark reddish-brown to yellowish, and is finely sculptured with many rows of minute punctures. A subsutural fold is sometimes developed with a concavity below it, and occasionally faint spiral folds are seen on the spire whorls.

*E. guesti* Powell agrees well with *E. subfusca* from many localities and must be considered a synonym. A series of shells from Stewart Island and Fiordland (fig. 15) was, at first, thought to be a different species, but comparison with long series show it is just a form of *E. subfusca*. It has a swollen body whorl, a larger, expanded aperture, convex whorls, and the colour is pinkish or reddish in the Stewart Island examples, but similar to typical *subfusca* in the Fiordland shells. Some samples from Stewart Island show integration of this form with *E. rekohuana* and *subfusca*. Since this form is rare at Stewart Island, it is probable that this is a hybrid which is not capable of breeding. The Fiordland shells are probably just variants of *subfusca*, as there is considerable variation in other ways. A series of shells from 100 fathoms off Puysegur Point, South West Otago, (fig. 16), are smaller, and pale, with a dark brown blotch on the base and on the columella. They are rather unlike any other specimens I have seen, but probably represent a deep-water population that has undergone partial differentiation due to isolation.

**Animal:** (Portobello, Dunedin Harbour). Colour of exposed animal largely dark grey owing to black pigment cells in the integument, but tips of tentacles, sole, and anterior end of snout are white. Snout short, bilobed; buccal mass dark grey. Tentacles rather short, club-shaped, compressed dorso-ventrally; eyes moderately large, on swellings at their outer bases. Foot rather short, truncated in front, anterior corners rounded, mucous slit extends from middle of sole to posterior end. Penis (pl. 17, fig. 12) muscular, wide, flattened, with a central silver-coloured line, about two coils, tip pointed, attached to the animal in mid-dorsal line a fair distance behind tentacles.

**Operculum:** (Pl. 17, fig. 13). Thin, transparent, oval, flattened, Nucleus small, lateral, of about two revolutions, the first revolution tiny and slightly thickened. A weak line emerging from the nucleus, runs down middle of operculum. On columella side of this line growth lines obscured by longitudinal, irregular markings, giving the surface a wavy appearance. Outer-side of line sculptured with faint growth lines only. The marginal area rather narrow, extending right around operculum. A slightly thickened patch on columella side of right end.

**Radula:** Similar to that of *E. zosterophila*. Central 2 + 1 + 2, with 2 basal processes. Lateral 2 + 1 + 2, with a long outer portion. Inner marginal with about 18 fine denticles, outer marginal appears to be smooth.



**Holotype:** (Fig. 12). Stewart Island (D.M.).

Height 2.8 mm. Width 1.375 mm.

**Material Examined:**

Holotype; Dunedin Harbour, Finlay Coll. (A.M.); Portobello, Dunedin Harbour, brown algae, soil red algae, under stones 3/9/63 (W.F.P.) and Finlay Coll. (A.M.); Ships' Channel side of Quarantine Island, Dunedin Harbour, fine red algae, coralline algae, 4/5/63 (W.F.P.); Bluff, oyster dredgings, -/9/56 (W.F.P.); Bluff, Finlay Coll. (A.M.); Foveaux Strait (G.S.) and Suter Coll. (G.S.); Middle Grounds, Foveaux Strait, 15-30 fathoms, O. Allan, -/6/51 (D.M.); Ulva Island, Paterson Inlet, Stewart Island, O. Allan, -/1/48 (D.M.) and E. Smith, -/1/48 (Powell Coll.); Stewart Island, 15 fathoms, A. Hamilton (Powell Coll.); Mason's Bay, Stewart Island, O. Allan, -/8/48 (D.M.); Port Pegasus, Stewart Island, 8-18 fathoms, M.V. "Alert" (G.S.), 16 fathoms, Suter Coll. (G.S.) and 5 fathoms, M.V. "Alert", 23/11/47 (D.M.); Bathing Beach, Stewart Island, O. Allan, 1950 (D.M.) and E. Smith (Hipkins Coll.); Halfmoon Bay, under stones, R. K. Dell, 30/10/48 (D.M.); Halfmoon Bay, Stewart Island, under stones, M. Spong, -/3/64 (W.F.P.); off Puysgur Point, 100 fathoms (D.M.); B.S. 104, Chalky Inlet, 20 fathoms, M.V. "Alert", W. H. Dawbin, 6/5/50 (D.M.); Dusky Sound, 30 fathoms, R. Henry (D.M.); B.S. 106, between Unnamed Island and Breaksea, Dusky Sound, 20 fathoms, W. H. Dawbin, M.V. "Alert", 7/5/50 (D.M.); B.S. 137, off Passage Point, Dusky Sound, 12-15 fathoms, M.V. "Alert", W. H. Dawbin, 8/1/52 (D.M.); Doubtful Sound, 50 fathoms, (W.F.P. and Hipkins Coll.); B.S. 107, Gaol Passage, Doubtful Sound, 25 fathoms, M.V. "Alert", W. H. Dawbin, 8/5/50 (D.M.); B.S. 110, inside entrance to George Sound, 15-20 fathoms, W. H. Dawbin, M.V. "Alert", 10/5/50 (D.M.); B.S. 185, Casewell Sound, 10 fathoms, M.V. "Alert", R. K. Dell, 23/3/49 (D.M.); B.S. 109, Bligh Sound, 25 fathoms, M.V. "Alert", W. H. Dawbin, 10/5/50 (D.M.); Snares Island, under stones, lower midlittoral, G. Knox, 29/1/61 (D.M.); Snares Islands, 50 fathoms, Finlay Coll. (A.M.); Waitangi, Chatham Islands, shell sand, A. W. B. Powell, -/2/53 (holotype and paratypes of *E. guesti* Powell) (A.M.); Waitangi, shell sand (G.S.); Chatham Islands Exped. Stat. 32, Waitangi, 7 fathoms, 3/1/54 (D.M.); Waitangi, in rock pools and on algae between tides, W. R. B. Oliver, -/12/09 (D.M.); Chatham Islands Exped., Port Hutt, Chatham Islands, shell sand, 8/2/54 (D.M.); Chatham Islands Exped. Stat. 16, Kaingaroa, R. K. Dell, 27/1/54 (D.M.); Chatham Islands Exped. Stat. 13, Owenga, 4-6 fathoms, R. K. Dell, 27/1/54 (D.M.); Chatham Islands Exped. Stat. 38, South of Little Mangere, 43 fathoms, M.V. "Alert", 2/2/54 (D.M.); Chatham Islands Exped. Stat. 2, 42° 50' S., 175° 30' E., Mernoo Bank, 61 fathoms, 23/1/54 (D.M.). *Subfossil*: Motunau Raised Beach (Hawera Series), (Upper Pleistocene) (G.S.).

**Distribution:** The south of the South Island, Stewart Island, and the Snares and Chatham Islands, from the lower littoral zone to moderately deep water.

***Estea subrufa* Powell.** Plate 21, figs. 14-16.

1937 *Estea subrufa* Powell, Disc. Rep. 15, p. 197-198, pl. 53, fig. 2.

The paratypes of *E. subrufa* are very variable (figs. 14, 15, 16). Some have fairly prominent axial ribs (fig. 14), and though these are apparently absent in the holotype, most paratypes have them developed to some extent. The species can be recognised by its small size, weak irregular axials, rounded, rather small aperture and short, inflated, conical, pinkish-red spire. The body whorl is white in large specimens, and at least half white in others.

**Holotype:** Discovery II Stat. 933 off Three Kings Islands in 260 metres (Brit. Mus.).

Height 2 mm. Width 1 mm. (from Powell)

**Material Examined:**

Paratypes (Powell Coll.); Discovery II Stat. 932, off Three Kings Islands,



185 metres (Powell Coll.); 4 fathoms, between Cape Maria Island and mainland, -/2/61 (Hipkins Coll.); Spirits Bay (Hipkins Coll.).

**Distribution:** Extreme North of New Zealand.

**Subgenus MICROESTEA n. subgen.**

Type: *Estea angustata* Powell, 1927

Shell similar to *Estea* in general form, but much thinner and more fragile, with a cylindrical, blunt-topped, spire. Protoconch dome-shaped, with exceedingly minute punctures in close spiral lines. Adult whorls smooth except for a subsutural cord and growth lines. Aperture large, expanded, pyriform, the angle posterior; inner lip broadly expanded, outer lip a little thickened, and an indistinct channel basally.

Animal, operculum and radula unknown.

***Estea (Microestea) angustata angustata* Powell. Plate 19, fig. 9.**

1927 *Estea angustata* Powell, Trans. N.Z. Inst., 57, p. 543, p. 27, fig. 10.

This species is easily recognised by its cylindrical spire, reddish spire whorls, minute size, and fragile shell. It has no sculpture except for a broad subsutural rib.

**Holotype:** (Fig. 3). Mangonui, 6-10 fathoms (Powell Coll.).

Height 1.625 mm. Width 0.525 mm.

**Material Examined:**

Holotype and paratypes; Discovery II Stat. 933, off the Three Kings, 260 metres (A.M.); 5 fathoms between Cape Maria Island and mainland, -/2/62 (Gardner Coll.); Tom Bowling Bay, shell sand (Gardner Coll. and Powell Coll.), Spirits Bay 1949 (Hipkins Coll.), Taputaputa, -/1/57 (Gardner Coll.); 22 fathoms,  $\frac{1}{2}$  mile South of Stephenson's Island, off Whangaroa (Hipkins Coll.); off Mayor Island, taken from fish stomachs, G. Williams (Powell Coll.).

**Distribution:** Far North and the North East of New Zealand, living in moderately deep water.

***Estea (Microestea) angustata jacosa* Laws. Pl. 19, figs, 10, 11.**

1940 *Estea jacosa* Laws, Trans. Roy. Soc. N.Z., 70, p. 48, fig. 32.

Closely related to *E. angustata* Powell, *E. jacosa* is here considered subspecific, and perhaps ancestral, to the recent form. The fossil differs in shape, in having a much weaker subsutural cord and fairly prominent axial growth striae. The paratypes are rather worn but show the striae behind the aperture. The recent subspecies has only very weak growth lines. The holotype has the protoconch missing but this can be seen in a paratype (fig. 11).

**Holotype:** (Fig. 10). Wilkie's Bluff, South Taranaki (Waitotarian) (G.S.).

Height 1.6 mm. (estimated) Width 0.6 mm.

**Material Examined:** Holotype and paratypes (G.S.).

**Distribution:** Waitotarian.

**A List of the New Zealand Recent and Fossil Species of ESTEA**

*Estea* Iredale, 1915. (= *Feldestea* Iredale 1955, *Nodulestrea* Iredale 1955).

- E. zosterophila zosterophila* (Webster, 1905).  
 \**E. zosterophila ngatutura* Laws, 1941.  
*E. asymmetrica* Laws, 1941.  
*E. hipkinsi* n. sp.  
*E. impressa* (Hutton, 1885) (= *E. verticosta* Powell and Bartrum, 1929).  
 \**E. insulana insulana* Marwick, 1928.  
*E. insulana porrecta* Powell, 1933 (= *E. c.f. insulana* Powell, 1933, and Dell, 1960).  
*E. insulana porrectoides* Powell, 1937.  
 \**E. koruahina* Laws, 1941.  
*E. manawatawhia* Powell, 1937.  
*E. micronema micronema* (Suter, 1898) (= *E. subtilicosta* Marwick, 1928, and *E. sculpturata* Dell, 1956).  
*E. micronema morioria* Powell, 1933.  
*E. minor* (Suter, 1898).  
 \**E. missile* Laws, 1940.  
 \**E. polysulcata* Finlay, 1924.  
*E. praecidecosta* n. sp.  
*E. rekohuana rekohuana* Powell, 1924.  
*E. rekohuana lactorubra* n. subsp.  
 \**E. rekominor rekominor* Laws, 1940.  
 \**E. rekominor cadus* Laws, 1950.  
*E. rufoapicata* (Suter, 1908) (= *E. rufoapicata latior* Dell, 1956).  
 \**E. rugosa* (Hutton, 1885).  
*E. semiplicata* Powell, 1927.  
*E. semisulcata* (Hutton, 1885).  
*E. subfusca* (Hutton, 1873) (= *E. guesti* Powell, 1933).  
*E. subrufa* Powell, 1937.  
 (*Microestea*) n. subgen.  
*E. (M.) angustata angustata* Powell, 1927.  
 \**E. (M.) angustata jacosa* Laws, 1940.  
 \* — Only known as a fossil.  
 = — Synonym.

APPENDIX I. Approximate specific time ranges.

International Correlation	N.Z. Stage	asymmetrica	impresa	micronema	missile	koruahina	semiplicata	rugosa	semisulcata	polysulcata	insulana	zosterophila	z. ngatutura	rekohuana	minor	subfusca	rekominor	r. cadus	a. jocosa
Recent		X	X	X			X		X			X		X	X	X			
Pleistocene	Castlecliffian		X									X		X	X	X			
	Nukumaruan		X	X	X		X	X	X	X								X	
	Hautawan		?				?												
Pliocene	Waitotaran		X		X				X										X
	Waipipian						X												
	Opoitian		X			X	X?		X				X					X	
Miocene	Altonian	X																	
Oligocene	Awamoan																		
	Hutchinsonian																		
	Otaian	X?	X																
	Waikakian																		
	Duntroonian		X					X											X? (aff.)

KEY: X occurrence; X? specific identity questioned; ? stage questioned; → suggested evolutionary origin.

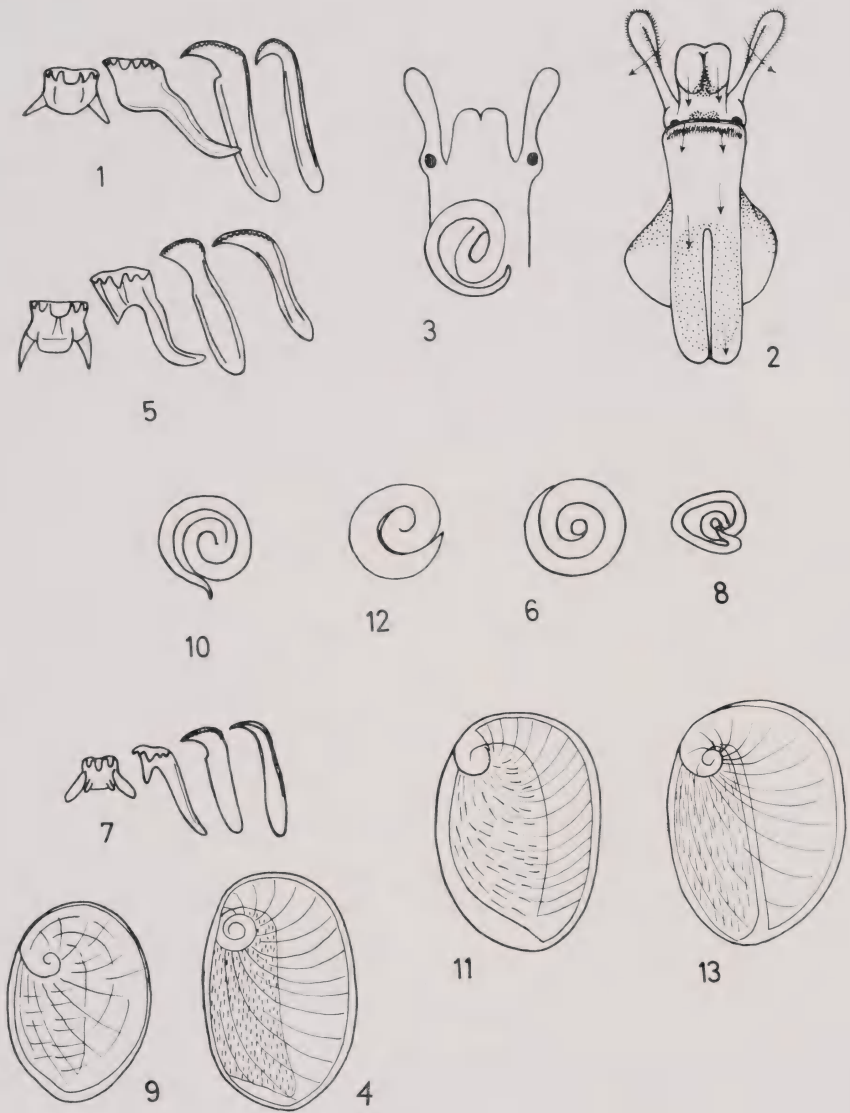


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*Estea zosterophila* (Webster).

- Figs. 1. Radula. 2. Ventral view of animal.  
3. Dorsal view of animal and penis.  
4. Operculum (inner side).

*Estea semiplicata* Powell.

- Fig. 5. Radula. 6. Penis.

*Estea impressa* (Hutton).

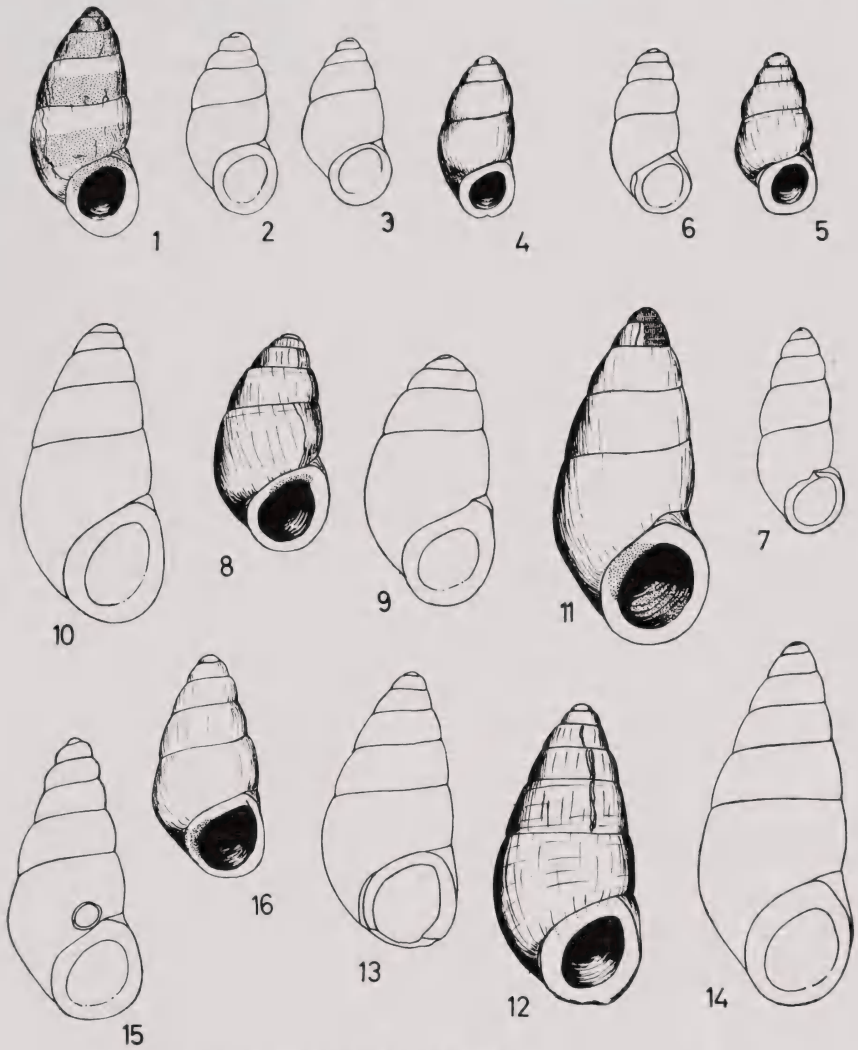
- Fig. 7. Radula. 8. Penis.  
9. Operculum (inner side).

*Estea rekohuana lactorubra* n. subsp.

- Fig. 10. Penis. 11. Operculum (inner side).

*Estea subfusca* (Hutton).

- Fig. 12. Penis. 13. Operculum (inner side).



*Estea zosterophila zosterophila* (Webster).

- Fig. 1. Lectotype, 2.15 x 0.975 mm.  
 2. Takapau Kura, Spirits Bay, 1.675 x 0.8 mm.  
 3. Takapau Kura, Spirits Bay, 1.55 x 0.8 mm.

*Estea zosterophila ngatutura* Laws.

- Fig. 4. Holotype, 1.5 x 0.7 mm.

*Estea minor* (Suter).

- Fig. 5. Lectotype, 1.5 x 0.7 mm.  
 6. Paralectotype, 1.55 x 0.725 mm.

*Estea* aff. *minor* (Suter).

- Fig. 7. Waimumu, 1.9 x 0.775 mm.

*Estea rekohuana rekohuana* Powell.

- Fig. 8. Holotype, 2.0 x 1.075 mm.  
 9. Carnley Harbour, Auckland Islands, 2.325 x 1.2 mm.  
 10. Ulva Island, Stewart Island, 2.75 x 1.3 mm.

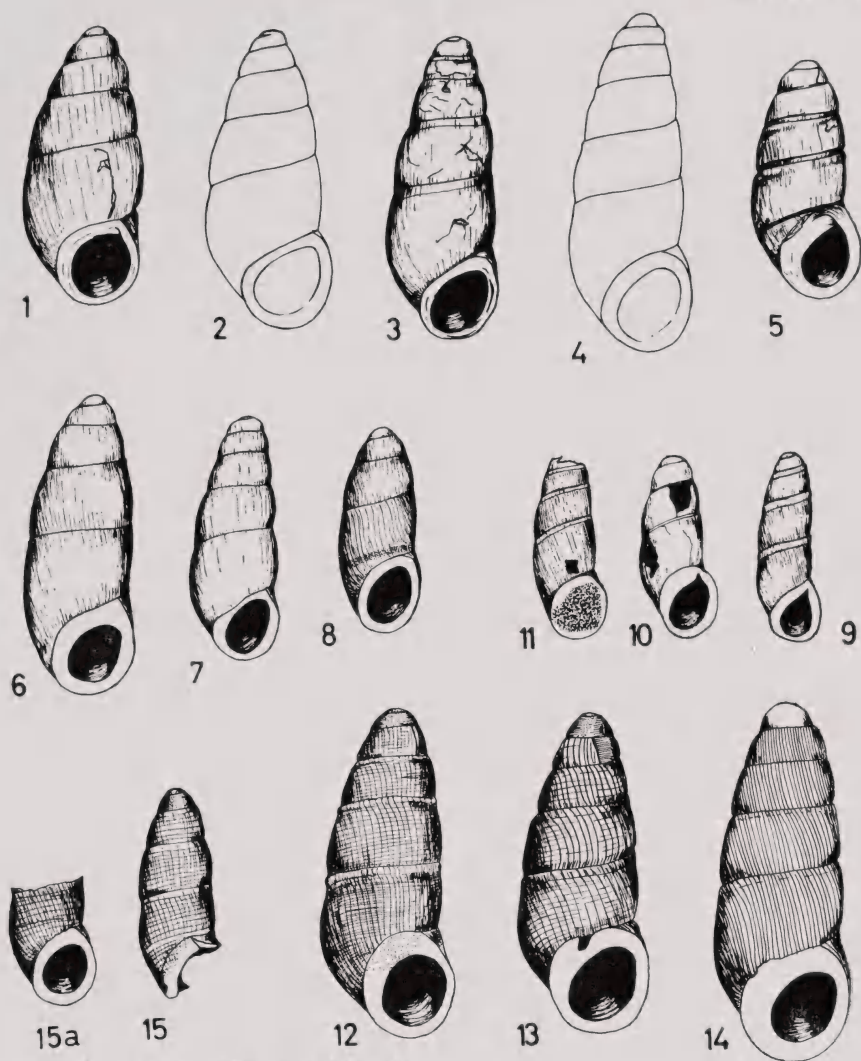
*Estea rekohuana lactorubra* n. subsp.

- Fig. 11. Holotype, 3.125 x 1.45 mm.

*Estea subfusca* (Hutton).

- Fig. 12. Holotype, 2.8 x 1.375 mm.  
 13. Holotype of *E. guesti* Powell, 2.6 (estim.) x 1.25 mm.  
 14. Port Pegasus, Stewart Island, 3.375 x 1.4 mm.  
 15. Ulva Island, Stewart Island (*subfusca* x *rekohuana*),  
 2.6 x 1.2 mm.  
 16. 100 fathoms, Puysegur Point, South-West Otago,  
 2.05 x 1.0 mm.





*Estea insulana insulana* Marwick.

Fig. 1. Holotype, 2.4 x 1 mm.

*Estea insulana porrecta* Powell.

Fig. 2. Cape Young, Chatham Islands (close to *insulana insulana*), 2.55 x 1.1 mm. 3. Holotype 2.575 x 0.95 mm.

3. Holotype 2.575 x 0.95 mm.

4. South of Little Mangere, Chatham Islands, 2.9 x 1.05 mm.

*Estea missile* Laws.

Fig. 5. Holotype, 2.025 x 0.9 mm.

*Estea insulana porrectoides* Powell.

Fig. 6. Paratype, 2.55 x 0.925 mm.

7. Discovery II Stat. 929, 2.1 x 0.225 mm.

8. Spirits Bay, 1.775 x 0.65 mm.

*Estea (Microestea) angustata angustata* Powell.

Fig. 9. Holotype, 1.625 x 0.525 mm.

*Estea (Microestea) angustata jacosa* Laws.

Fig. 10. Holotype, 1.6 (estim.) x 0.6 mm. 11. Paratype, 1.6 x 0.625 mm.

*Estea micronema micronema* (Suter)

Fig. 12. Lectotype, 2.825 x 1.15 mm.

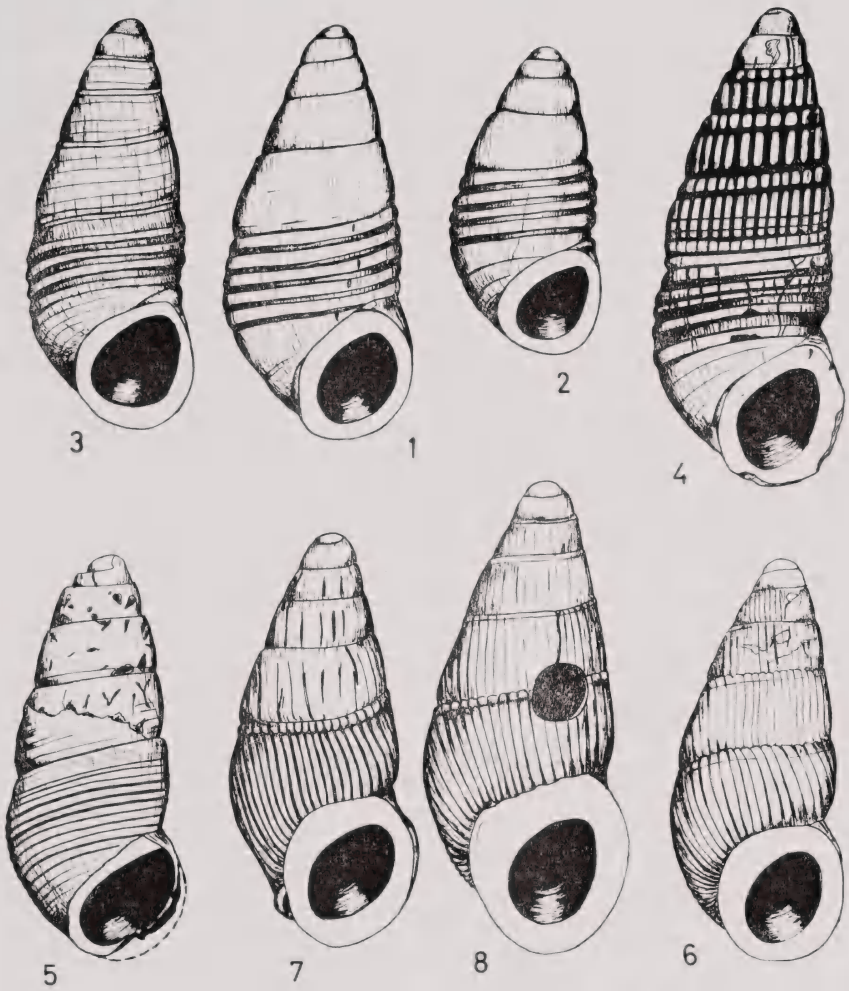
13. Holotype of *E. sculpturata* Dell, 2.725 x 1.1 mm.

14. Holotype of *E. subtilicosta* Marwick, 3.1 x 1.15 mm.

*Estea micronema morioria* Powell.

Fig. 15, 15a. Holotype (2 fragmentary specimens)

1.9 (estim.) x 0.7 (estim.) mm. (Fig. 15).



*Estca semisulcata* (Hutton).

- Fig. 1. Lectotype, 3.7 x 1.7 mm.  
 2. Paralectotype, 2.75 x 1.4 mm.  
 3. 22 fathoms off Stephenson's Island, off Whangaroa,  
 3.675 x 1.5 mm.

*Estca rugosa* (Hutton).

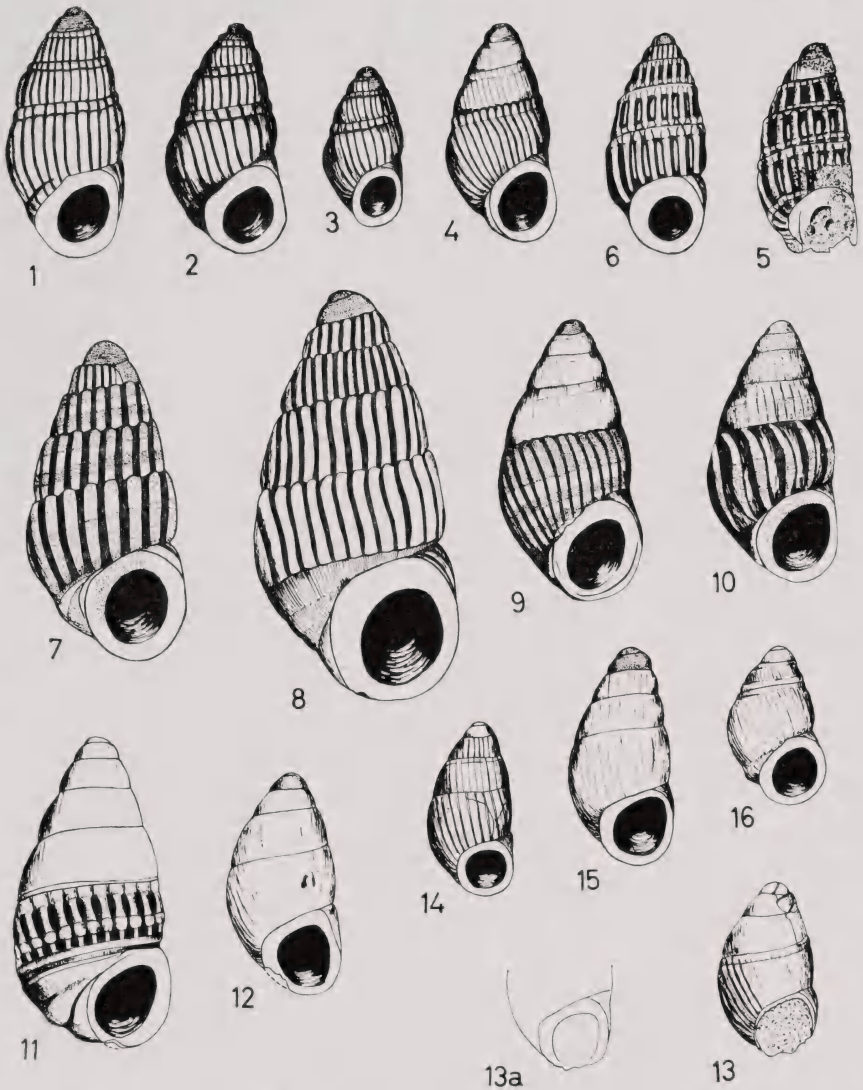
- Fig. 4. Lectotype, 4.3 x 1.75 mm.

*Estca polysulcata* Finlay.

- Fig. 5. Holotype, 3.6 (estim.) x 1.6 (estim.) mm.

*Estca rufoapicata* (Suter).

- Fig. 6. Lectotype, 3.6 x 1.6 mm.  
 7. Holotype of *E. rufoapicata latior* Dell, 3.7 x 1.7 mm.  
 8. Paratype of *E. rufoapicata latior* Dell, 4.3 x 1.85 mm.

*Estea impressa* (Hutton).

- Fig. 1. Lectotype, 2.275 × 1.05 mm.  
 2. Leigh (large form) 2.1 × 1.1 mm.  
 3. Leigh (small form) 1.425 × 0.7 mm.

*Estea olivacea* (Frauenfeld).

- Fig. 4. Sydney, New South Wales, Australia, 2.0 × 0.95 mm.

*Estea asymmetrica* Laws.

- Fig. 5. Holotype, 1.95 × 0.875 mm.  
 6. Off Mayor Island, 2.0 × 0.9 mm.

*Estea manawatawhia* Powell.

- Fig. 7. N.Z.O.I. Stat. C. 760, 2.9 × 1.4 mm.

*Estea praecidecosta* n. sp.

- Fig. 8. Holotype, 3.7 × 1.775 mm.

*Estea hipkinsi* n. sp.

- Fig. 9. Holotype, 2.375 × 1.25 mm.

*Estea semiplicata* Powell.

- Fig. 10. Holotype, 2.375 × 1.15 mm.

*Estea koruahina* Laws.

- Fig. 11. Holotype (reconstructed) 2.8 × 1.45 mm.

*Estea rekominor rekominor* Laws.

- Fig. 12. Holotype, 2.0 × 1.025 mm.

*Estea rekominor cadus* Laws.

- Fig. 13. Holotype, 1.6 (estim.) × 0.875 mm.

*Estea subrufa* Powell.

- Fig. 14. Paratype, 1.6 × 0.775 mm. 15. Paratype, 2.0 × 0.95 mm.  
 16. Paratype, 1.45 × 0.75 mm.